

Project Manual



FULLER MIDDLE SCHOOL

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Date of Issue:

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Volume 2 of 3

Divisions 06 to 23

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<i>Date</i>	<i>Issue</i>	<i>Section Number & Title</i>
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DIVISION 22 — PLUMBING

<i>Date</i>	<i>Issue</i>	<i>Section Number & Title</i>
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11/22/19	CD	Section 22 00 00 Plumbing (* Trade Contract Required as part of Section 22 00 01)
11/22/19	CD	Section 22 00 01 * Plumbing Trade Contract Requirements (* Trade Contract Required)
11/22/19	CD	Section 22 08 00 * Commissioning of Plumbing (* Trade Contract Required as part of Section 22 00 01)

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VOLUME 3 (DIVISIONS 26 THROUGH 33 + APPENDICES)

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<i>Date</i>	<i>Issue</i>	<i>Section Number & Title</i>
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05/10/19	ESP	Section 31 25 00 Erosion & Sedimentation Controls
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<i>Date</i>	<i>Issue</i>	<i>Section Number & Title</i>
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05/10/19	ESP	Section 33 10 00 Water Utilities
05/10/19	ESP	Section 33 31 00 Sanitary Utility Sewerage Piping
05/10/19	ESP	Section 33 41 00 Storm Utility Drainage Piping

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05/10/19 ESP Section 33 49 23 Storm Drainage Retention Structures

APPENDICES

<i>Date</i>	<i>Issue</i>	<i>Appendix Number & Title</i>
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11/22/19	CD	Appendix B Code Report
11/22/19	CD	Appendix C Foodservice Cut Sheets
11/22/19	CD	Appendix D Soil Management Plan
11/22/19	CD	Appendix E Hazardous Materials Summary Report

End - Table of Contents

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Section 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of rough carpentry where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Fire retardant treated plywood wall panels for mounting of panelboards, telephone/data backboards, HVAC, IDF AV and fire control equipment and other equipment.
 - 2. Various wood blockings, edgings, nailers, curbs, cants, grounds, furring, sheathing, framing members including wood preservative, as required for receipt of various finishes and surfacing materials, not described herein above.
 - 3. Pressure preservative treated solid wood and plywood blocking required for all Roofing and flashing work scope.
 - 4. Laminated Veneer Lumber (LVL) at roof rim board, window openings and elsewhere indicated.
 - 5. Rough installation hardware, including bolts, screws, spikes, nails, clips, and connection assemblies, as needed for installation of the rough carpentry work.
- C. Install the following furnished under the designated Sections:
 - 1. Concealed anchorage devices for handicap handrails in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.
- D. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work. Furnish and install furring, blocking, and shims, and other usual items of normal rough carpentry work as required by the various trades for the proper completion of the project.
 - 1. The applicable requirements specified in Part 1 - GENERAL and Part 3 - EXECUTION of the individual specification sections furnishing materials to be installed under this Section, shall be included in and made a part of this Section.
- E. No attempt is made in this Section to list all elements of rough carpentry required on this project or to describe how each element will be installed. It is the

responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood trim.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK.
- E. Section 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING: Membrane roofing system, and related wood blocking.
- F. Section 07 62 00 - SHEET METAL FLASHING AND TRIM.
- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal framing.
- H. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- I. Section 09 29 00 - GYPSUM BOARD: Wall board construction work, having taped and compounded joint finish.
- J. Section 09 21 17 - SHAFT WALL ASSEMBLIES
- K. Section 09 91 00 - PAINTING: Applied primer and finish coatings to exposed to view rough carpentry work.
- L. Section 10 28 13 - TOILET ACCESSORIES: Providing anchorage devices and mounting templates for toilet accessories.
- M. Division 26 - ELECTRICAL: Providing and mounting electrical panels and equipment.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. APA - applicable grades and specifications.
 - 2. APA PRB-108 Performance Standards and Policies for Structural-Use Panels..
 - 3. ASTM D 3201 - Test Method for Hygroscopic Properties of Fire-Retardant Wood.

4. AWPAs Standards and references for preservative treated wood including Standards UC1, UC2, UC3A, UC3B, UC4A, and P5
5. AWPAs Standard UCFA – Fire Protection as Required by Codes Above Ground Interior Construction.
6. AWPAs Standard UCFB – Fire Protection as Required by Codes Above Ground Exterior Construction.
7. AWPAs M4 – Care Of Preservative Treated Wood Products.
8. NER-643: ACQ Preserve® and ACQ Preserve Plus® Wood Preservative Treatment, ICBO Evaluation Service.
9. MIL L-1914OE - Lumber and Plywood, Fire Retardant Treated.
10. SPIB Grading Rules, current edition.
11. UL - Building Materials Directory
12. US. Department of Commerce Voluntary Product Standard PS1 for Construction and Industrial Plywood.
13. US. Department of Commerce Voluntary Product Standard PS2 for Wood-Based Structural-Use Panels.
14. US. Department of Commerce Voluntary Product Standard PS-20 - American Softwood Lumber Standard.
15. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
16. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for locating anchorages installed into blocking which is provided under this Section.
 2. Coordinate work of this Section with the work of the various trades responsible for applying finish materials and other items to rough carpentry work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for products specified herein.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all adhesives. Submit MSDS highlighting VOC limits.
 2. Certifications:

- a. Written certification from the respective treatment plants indicating types of wood preservative treatment and fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
 - 1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
 - 2) Provide report from ICC Evaluation Service on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
 - 3) Provide report from ICC Evaluation Service on pressure preservative treated wood strength, corrosion, anti-fungi, and anti-insect properties.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 1. All lumber shall:
 - a. Be new, dressed four sides (S4S), clear and free from warping and other defects.
 - b. Have a moisture content not exceeding 19 percent when delivered to the project.
 - c. Be in accordance with the grading rules of the lumber manufacturer's association under whose jurisdiction the lumber is produced and bear the mark of grade and mill identification.
- B. Certifications:
 1. Plywood: Conform to the requirements of Product Standard PS-1, and bear applicable APA grade trademarks.
 - a. Plywood for electrical boards treated for retardance, meet Class I or a flame spread rating of 25 or less and bear U.L. label "Classified FRS".

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
- B. Store all materials in an elevated dry location, protected by waterproof coverings.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.2 BOARD AND SHEET MATERIALS

- A. Lumber for blocking, nailers and curbs as indicated or required: Hem-Fir, Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried stud or utility grade. Wood members shall be of sizes indicated on the Drawings or of the same size as the members being braced.

1. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
 2. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- B. Furring: Nominal 1 by 3 inches or 1 by 4 inches Douglas Fir, Eastern Spruce, Eastern Hemlock, or Southern Pine, surfaced dried construction grade.
- C. Plywood and sheet products:
1. For substrate beneath gypsum board: Square edge APA graded C-D-X EXT, touch-sanded, 1/2 inch thick, except as otherwise indicated on the Drawings
 2. For electric panel board mountings and similar uses: APA graded B-D INT, Group 2 species, touch-sanded, fire-retardant treated, 3/4 inch thick, except as otherwise indicated on the Drawings.
 3. For unspecified interior concealed from view locations: APA graded C-D PLUGGED INT, Group 2 species, thickness as indicated on the Drawings.

2.3 LAMINATED VENEER LUMBER (LVL)

- A. Laminated Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.
1. Minimum design performance values:
 - a. Extreme Fiber Stress in Bending (F_b), edgewise; 2600 pounds per square inch.
 - b. Horizontal shear (F_v); 285 pounds per square inch.
 - c. Compression perpendicular to grain (F_c) for bottom lamination; 500 pounds per square inch.
 - d. Tension parallel to grain (F_t); 2200 pounds per square inch.
 - e. Compression parallel to grain (F_t); 2900 pounds per square inch.
 - f. Modulus of elasticity (E), edgewise; 1,900,000 pounds per square inch.
 2. Veneers: Douglas Fir, Southern Pine, Yellow Poplar, or better
 3. Veneer adhesive: waterproof type conforming to ASTM D-2559.
- B. Laminated Veneer Lumber shall be identified by a stamp indicating the product type, manufacturer's name, plant number and the independent inspection agency logo and evaluation report number.

2.4 WOOD TREATMENTS

- A. Treated wood products shall be produced by a single treatment plant, fully licensed by the chemical manufacturers, and conforming to the requirements specified herein.
1. Toxicity and Environmental Quality:
 - a. Products containing chromium will not be permitted.
 - b. Products containing arsenic will not be permitted.

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- c. Fire-retardant-treated wood products shall be free of halogens, sulfates, ammonium phosphate and formaldehyde.
 2. Dye wood or otherwise color code all treated wood at treatment plant to clearly distinguish the different treatments in the field.
 3. Kiln dry all treated lumber and plywood to the following maximum moisture content after treatment.
 - a. Lumber: 19 percent.
 - b. Plywood 15 percent.
 - c. Discard pieces with defects which might impair quality of work.
 4. Quality marks: Each piece of lumber and plywood shall be permanently affixed with a quality mark, containing the following information:
 - a. Identification of the inspection agency.
 - b. Standard to which material was treated.
 - c. Identification of the treating plant.
 - d. Fire retardant treated wood shall include: stamp signifying a FR-S rating
 - e. Preservative treated wood shall include: Retention and end use for which product is suitable.
 - B. Fire retardant treated wood. Designated as "FRTW"
 1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
 - a. Arch Wood Protection, Atlanta, GA., product, "Dricon FRT Wood".
 - b. Osmose, Inc., Griffin GA., product "FirePro".
 - c. Hoover Treated Wood Products, Inc., Thomson, GA product "PyroGuard".
 - d. Viance, LLC., Charlotte, NC, product: "D-Blaze FRT".
 2. Fire retardant treated wood shall comply with the following requirements:
 - a. All fire-retardant lumber and plywood must have an Underwriters Laboratories stamp signifying a FR-S rating certifying a 25 or less flame spread and smoke developed value, when tested in accordance to ASTM E-84, or UBC Standard No. 42-1.
 - b. Corrosion rates: Less than one mil per year for carbon steel, galvanized steel, aluminum, copper and red brass in contact with the fire retardant treated wood when tested in accordance with Federal Specification MIL-L-19140E Paragraph 4.6.5.2.
 - c. The fire retardant treated wood must have an equilibrium moisture content of not more than 25 percent when tested in accordance with ASTM D 3201 procedures at 95 percent relative humidity and 80 degrees Fahrenheit.
 - d. Fire retardant chemical: Registered for use as a wood preservative by the U.S. Environmental Protection Agency.
 - e. Testing: Fire performance and strength properties for both lumber and plywood, of the fire retardant treated wood shall be recognized by issuance of a ICC Evaluation Service Report. Fire retardant chemical must not damage the middle lammella of the wood structure when

exposed to 170 degrees Fahrenheit and 90 percent relative humidity for 23 days.

- C. Pressure preservative treated wood. Designated as "PT"
 - 1. Chemical Manufacturer: Subject to compliance with the requirements specified herein, Products which may be incorporated in the work include:
 - a. Osmose, Inc., Griffin GA., product "NatureWood".
 - b. Universal Forest Products, Inc., Grand Rapids MI., product "ProWood ACQ".
 - c. Viance, LLC., Charlotte, NC., product "Preserve"
 - 2. Treatment: Ammoniacal Copper Quaternary Compound (ACQ), arsenic-free and chromium-free chemical "ACQ Preservative" in accordance with AWPA Standards. Apply the preservative in a closed cylinder by pressure process in accordance with AWPA Standard C15.
 - a. Minimum preservative retention for floor plates, framing, lumber and plywood above ground use: 0.25 pounds per cubic foot (4.0 kg/m³) of ACQ chemical, in accordance with AWPA UC1, UC2, UC3A, and UC3B, or NER-643 as appropriate.
 - b. Minimum preservative retention for framing, lumber and plywood in contact with water, ground, concrete and masonry: 0.40 pounds per cubic foot (6.4 kg/m³) of ACQ chemical, in accordance with AWPA UC4A, UC4B, UC4C, or NER-643 as appropriate.
 - c. Minimum preservative retention for lumber and plywood in permanent wood foundations: 0.60 pounds per cubic foot (9.6 kg/m³) of ACQ chemical, in accordance with AWPA UC4B, or NER-643.
 - 3. Fixation of Chemical: Treated wood shall not be shipped from treatment plant until fixation of the preservative has occurred in the wood.

2.5 ACCESSORIES

- A. Adhesives:
 - 1. General: Provide adhesives approved which are Low-VOC or non-VOC, non-flammable, water-proof after cured, odor free, and comply with LEED certification requirements.
 - 2. Adhesive for lamination and fabrication of wood and plywood items: Exterior adhesives containing no urea formaldehydes, having a VOC limit of 70 g/L.
 - 3. Adhesive for subfloors and underlayment: High strength, waterproof and non-freezing adhesive complying with AFG-01 "Frozen Lumber Test" and ASTM 3498, and having a VOC limit of 50 g/L.
- B. Nails (interior and exterior): Galvanized common nails, of size and type to suit application and as required by state and local building codes.
- C. Screws:
 - 1. Screws for interior applications: Flat head electroplated-galvanized wood screws of the appropriate sizes.
 - 2. Screws for exterior applications:

- a. For ACQ pressure preservative treated wood: Flat head type 304 or 316 stainless steel only, wood screws, of the appropriate sizes. Aluminum, galvanized steel, and coated metal fasteners are prohibited.
 - b. For general application (non-pressure preservative treated wood): Flat head hard aluminum, or stainless steel, wood screws, of the appropriate sizes.
- D. Anchor bolts, expansion bolts and lag screws: Hot-dipped galvanized steel, of the following types:
- 1. For lumber having actual thickness of 1-1/2 inches or greater to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, 3/8-inch minimum diameter, spaced as shown on drawings, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
 - 2. For lumber having actual thickness of greater than 7/8-inch but less than 1-1/2 inches to masonry and concrete: Anchor bolts or expansion bolts, as most applicable for the specific receiving surface material, at least 1/4-inch diameter of the most appropriate lengths for the specific application, spaced as shown, and staggered as far as practicable. Countersink all bolt heads, and provide head washers of matching material.
 - 3. For lumber having actual thickness of 7/8-inch and less: Anchor bolts or expansion bolts, at least 1/4-inch in diameter; or screws, of the most appropriate sizes; in lengths most suitable for the specific application, countersunk, spaced, and staggered.
- E. Protection paper: Canadian red-rosen paper or kraft paper.
- F. Building paper: ASTM D 226, Non-perforated, No. 15 (73 kg/sq m) asphalt-saturated building felt.

PART 3 - EXECUTION

3.1 PREPARATION

- A. All materials shall be inspected before use, with all checked, split and otherwise deficient stock rejected, or used only for miscellaneous blocking, furring or other incidental use. The Contractor shall be responsible for replacing all lumber which, due to warpage, twist, splitting, or checking, results in unsatisfactory work. Such replacement shall be required at any time, whether before or after application of finish material under other Sections.
- B. Verify exact locations of toilet accessories, door stops and similar items with Architect prior to installation of blocking for accessories.

3.2 INSTALLATION - GENERAL

- A. Closely coordinate the installation of the rough carpentry work with the work of other trades responsible for the installation of interfacing or overlaying materials, so as not to delay the work of the related trades.
- B. Erect all rough carpentry work plumb, level, and true with tight, close fitting joints, securely attached and braced to surrounding construction, all in a first class workmanlike manner. Counterbore for bolt heads, nuts, and washers where

required to avoid interference with other materials. Bear complete responsibility for structural integrity, connections, and anchorage of all rough carpentry work.

- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
- D. Use as long lengths as practicable for wood nailers, blockings, and curbs, to minimize number of joints, and attach the members with the types, and spacing, of fasteners specified herein.
- E. Install blocking, grounds and furring, as required for proper attachment of the work of other trades, in accordance with the requirements provided by the respective related trades.
 - 1. Spacing for furring and strapping shall not exceed 16 inches on center.
- F. Field cuts of fire retardant treated lumber: Do not rip or mill fire retardant treated lumber. Only end cuts, drilling holes and joining cuts are permitted.
- G. Field cuts of ACQ pressure-treated lumber: Apply solution of copper naphthenate containing a minimum of 2 percent metallic copper in-solution, in accordance with AWWA standard M4. Brush liberally all cuts and holes.
- H. Install concealed from view plywood with specified fasteners spaced not more than 10 inches on centers.
- I. Install fire-treated plywood backer boards with counter-sunk galvanized fasteners, of specified sizes, spaced not more than 12 inches on centers.

3.3 INSTALLATION - ROOF NAILERS AND BLOCKING

- A. General: Provide anchorage for nailers as required for roof and edging to obtain specified wind loading requirements.
 - 1. Secure nailers and blocking to metal deck with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 3/4-inch below deck.
 - 2. Secure nailers and blocking to wood substrates with electro-galvanized screws at not greater than 12 inch on center spacing, extending a minimum of 1-1/2 inch into board substrates and 3/4 inches into sheet materials.
- B. When building up layers of nailers and blocking, fully secure each layer to at least the one below, alternating location of fasteners, spacing at 12 inches on center. Provide fasteners in lengths to penetrate through more than one substrate layer of blocking. Stagger locations of butt ends of boards, such that no two joints are "lined up".
- C. Ensure finished height of nailers is same as top surface of roof insulation within 1/4-inch, plus or minus.

3.4 INSTALLATION – PANELS FOR MOUNTING EQUIPMENT BACKBOARDS

- A. Provide wall panel backboards for HVAC, Fire Prevention, Electrical and telephone/data equipment. Provide wall panels on all walls of, electric rooms, emergency electric rooms, Audio/Visual closets and IDF.
- B. Fabricate panels using fire-retardant treated 3/4 inch thick panels mounted to fire-retardant treated 2 by 4's. Provide a nominal space of 3-1/2 inches behind panels to permit wiring.
 - 1. Prime and paint wall panels on both sides prior to installation, coordinate with Section 09 91 00 – PAINTING.

3.5 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

3.6 SCHEDULES

- A. Wood treatment schedule:
 - 1. Pressure preservative treat all concealed or exposed-to-view:
 - a. Lumber and plywood which comes in contact with concrete, masonry, or earth.
 - b. Lumber and plywood nailers, blocking and curbing directly related to roofing, flashing, skylights, roof hatches, and roof accessories.
 - c. LVL, Lumber and plywood rough-bucks, blocking and nailers directly related to windows, and storefront systems.
 - 2. Fire retardant treat all equipment backer boards, additionally provide fire retardant treated lumber and plywood where indicated or noted on Drawings.
- B. Wood blocking schedule: The following schedule lists common items for which blocking is required and may not be indicated on the Drawings. It is not the intention of this schedule to list all conditions requiring blocking or limit the extent of blocking required for completion of the Work; provide all wood blocking, edgings, nailers, required for receipt of various finishes and surfacing materials. Securely anchor wood blocking and run continuous between framing.
 - 1. Interior wood blocking sizes indicated below are minimum sizes for conditions which not otherwise sized or indicated on Drawings. In case of conflict, sizes identified on Drawings govern.

Interior Items	Nominal size of blocking with fastener notes
Door Frames, having openings exceeding 4 feet in width;	2 by 4 inch, full height of wall framing
Door frames, cross corridors;	2 by 4 inch.
Door frame heads, of sliding, accordion, and bifolding doors;	2 by 4 inch
Door stops, wall mounted;	1 by 3 inch.
Grab bars;	2 by 6 inch, with 1/4 inch dia. toggle bolts.
Lavatories;	3/4 inch plywood extending full height from floor to top of wall framing. Install lavatories with 1/4 inch dia. toggle bolts
Mirrors, framed;	2 by 4 inch
Shower rods;	2 by 4 inch
Soap dispensers, wall mounted;	1 by 3 inch
Paper towel dispensers, waste receptacles, feminine napkin dispensers;	1 by 3 inch.
Toilet paper dispensers;	2 by 4 inch
Towel bars;	2 by 6 inch, 1/4 inch diameter toggle bolts
Wall mounted railings;	2 by 8 inch
Window treatment (shades, blinds and curtains):	2 by 4 inch
Products bracketed to walls (including sinks, cabinets and similar products):	3/4 inch plywood extending full height from floor to top of wall framing. Install brackets with 1/4 inch dia. toggle bolts

End of Section

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Section 06 16 00
SHEATHING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of exterior sheathing board where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Exterior sheathing board.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY: Installation of metal masonry ties.
- D. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing wall framing.
- E. Section 07 11 13 - BITUMINOUS DAMPPROOFING.
- F. Section 07 21 00 - THERMAL INSULATION: Cavity wall insulation.
- G. Section 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS
- H. Section 09 29 00 - GYPSUM BOARD: Gypsum board system installation.
- I. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply, and return air registers.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to

establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
2. ASTM C 1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
3. GA 201 - Gypsum Board for Walls and Ceilings.
4. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of fire rated assemblies.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 - UNIT MASONRY

C. Scheduling:

1. Do not install sheathing until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings: Details of any special conditions associated with fireproofing.
3. Sustainable Design Submittals:
 - a. Recycled content: Provide manufacturer's written certification of recycled content as defined in accordance with International Standard ISO 14021–1999, Environmental Labels and Declarations—Self-Declared Environmental Claims (Type II Environmental Labeling). Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources. (LEED Credit MRc4).

1.7 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

B. Qualifications:

1. Installer: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 MOCK-UP

- A. Provide mock-up elements for field panel in accordance with Section 01 43 39 – MOCKUPS at exterior location where directed by Architect. Mock-up will demonstrate quality of work, construction methods, relationship to other work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - a. Neatly stack board materials flat to prevent sagging.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty:
 1. Sheathing manufacturer's 12 month warranty for coverage against in-place exposure damage. Warranty shall commence on date of material purchase.
 2. Sheathing manufacturer's 5 year limited warranty covering materials commencing on date of Project Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. United States Gypsum Company, Chicago IL. (USG), product "Securock Glass-Mat- Regular" and "Securerock, FireCode X"
 2. Georgia Pacific Corporation, Gypsum Division, Atlanta GA, product: "DensGlass Sheathing," and "DensGlass Fireguard".
 3. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond), product: "e²XP Sheathing," and "e²XP Sheathing Fire-Shield."

4. Lafarge North America, Inc., Reston VA, product: "Weather Defense Platinum," and "Weather Defense Platinum Sheathing Type X."

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 MATERIALS

- A. Sheathing Board: 5/8 inch thick gypsum sheathing board, Type X complying with ASTM C 1177 with fiberglass mat surface front and back with silicone-treated gypsum core conforming with the following requirements:

Properties	Test	Results
Surfacing:		Glass mat
Width:		4'-0" nominal
Length:		10'-0" (+/- 1/4 inch) maximum
Flexural Strength, lb/ft parallel (4'-0" weak direction):	ASTM C 473	100 pounds
Humidity Deflection, (inches):	ASTM C 473	1/8 inch, maximum
Linear Expansion with Change Moisture (in/in % RH):	ASTM C 518	6.25×10^{-6} , maximum
Thermal resistance "R" (in/ft ² °F/Btu):	ASTM C 518	0.56 minimum
Weight (per 1,000 sq ft):	ASTM C 1177	2,500 pounds minimum
Bending Radius	ASTM C 1177	8 feet, minimum
Mold growth:	ASTM D 3273	Score 10 with no mold detected
Racking Strength, lbs/ft, dry (ultimate):	ASTM E 72	>654 pounds per foot
Surface burning characteristics:	ASTM E 84	Flame spread: 10, maximum
Permeance (ng/Pa•s•m ²):	ASTM E 96 (dry cup method)	17 perms, maximum
Combustibility:	ASTM E 136	Noncombustible
Coefficient of Thermal Expansion (in/in/°F):	ASTM E 228 modified	8.5×10^{-6} , maximum

2.4 ACCESSORIES

- A. Fasteners for 5/8 inch thick sheathing: Type S-12 fine thread rust resistant self-drilling screws, for applying single layer sheathing board to light gage metal framing.
1. Fastener length for layer sheathing application: 1-1/4 inch [32 mm].
 2. Fastener length for double layer sheathing application: 2 inch [50 mm].

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Beginning of installation means acceptance of framing and project conditions.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
 - 1. Verify that surface of framing and furring members to receive sheathing does not vary more than 1/4 inch from the placement of faces of adjacent members.

3.2 INSTALLATION

- A. Install sheathing in strict compliance with manufacturer's recommended installation instructions and as specified here, comply with all applicable code requirements.
 - 1. Install specified control joints where indicated on Drawings. Run vertical control joints continuously to top of wall.
- B. Secure sheathing with long dimension perpendicular to wall studs with ends over firm bearing, stagger joints where possible. Use maximum lengths possible to minimize number of joints.
 - 1. Install sheathing with panel edge joints no greater than 1/8 inch (maximum) spacing to abutting sheathing panels and at all sheathing termination edge and end joints.
 - 2. For metal framing: Install screws with 8 inch on center spacing 1/2 inch in from edge around perimeter of each sheathing board, and 8 inches on center in field.
 - 3. Drive fasteners tight and flush with surface of sheathing, do not countersink.

3.3 CLEANING

- A. General: Clean work under provisions of Section 01 70 00 – EXECUTION.
 - 1. Daily clean work areas by sweeping and disposing of debris, and scraps.
 - 2. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

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Section 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Stage flooring including vented wall base.
 - 2. Interior finish wood trim, and medium density wood trim (MDF), scheduled for field-painted finish.
 - 3. Wood marker tray/bumper rail.
 - 4. Seamless resilient tackboard surfacing.
 - 5. Shelf jamb light reflectors
 - 6. Window stools.
 - 7. Adjustable wall mounted shelving with standards and brackets.
 - 8. Storage and closet shelving, coat rods and related hardware.
- B. Install the following furnished under the designated Sections:
 - 1. Plastic laminated shelves (for wall mounted adjustable shelving) furnished by Section 06 40 00 - ARCHITECTURAL WOODWORK.
- C. Backprime all interior window stools, and all wood which comes in contact with cementitious and masonry materials

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, framing, curbs, nailers, and backer boards.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK:
 - 1. Furnishing and installing cabinetry, plastic laminated shelving, and other built-in-place furniture.

- 2. Plastic laminated countertops.
- E. Section 07 92 00 - JOINT SEALANTS: Sealant and backing materials, for joints between casework, countertops and abutting surfaces.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing hollow metal doors.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors.
- H. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.
- I. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.
- J. Section 09 91 00 - PAINTING: Field applied primer (excluding back priming) and finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A250.11 (formerly SDI 105) - Recommended Erection Instructions for Steel Doors and Frames.
 - 2. APA - applicable grades and specifications.
 - 3. FS MM-L-736 - Lumber; Hardwood
 - 4. PS-1 - Construction and Industrial Plywood.
 - 5. PS-20 - American Softwood Lumber Standard.
 - 6. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
 - 7. SPIB Grading Rules, current edition.
 - 8. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber
 - 9. American Lumber Standards Committee, National Lumber Grades Authority for Canadian Lumber, and applicable grading rules and standards of the various lumber associations whose species are being used for grades specified.
 - 10. AWPA C-20 - Structural Lumber Fire Retardant Treatment by Pressure Processes.
 - 11. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
 - 12. MIL L1914OE - Lumber and Plywood, Fire Retardant Treated.
 - 13. UL Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.

C. Definitions:

1. AWI: American Woodwork Institute
2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada
3. WI: Woodwork Institute.
4. NAUF: No added Urea Formaldehyde.

1.5 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.
2. Certification:
 - a. Fire Treatment: Written certification from the respective treatment plants indicating types of fire-retardant treatment used, treatments method, applications instructions, and conformance to the requirements specified herein.
 - 1) Provide certification that fire retardant treatment materials do not contain ammonium phosphate.
 - 2) Provide report from National Evaluation Service Committee on fire retardant treated wood flame spreading, strength, corrosion and hygroscopic properties.
 - b. Certify that all composite wood and agrifiber products used on this Project are NAUF.
 - 1) Written certification from Millworker, that only "no-added formaldehyde" (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
3. Shop drawings:
 - a. Large scale design details, minimum 1-1/2 inch to one foot scale, showing profiles, jointing and fastening methods; and complete installation details.
 - b. Provide full scale drawings of wood trim elements required to match existing, showing all profiles and dimensions.
 - c. Provide shop drawings bearing dimensions of actual measurements taken at the project.
4. Samples: Provide samples as requested by Architect for selection of colors and finishes.

1.6 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI *Architectural Woodwork Standards*, 2nd. Edition, as amended by published errata, for Premium Quality Grade.
- B. Discard lengths of material which are unsound, warped, bowed, twisted, improperly treated, not adequately seasoned or too small to fabricate work with minimum of joints or optimum jointing arrangements, or which are of defective manufacture with respect to surfaces, sizes or patterns.

1.7 DELIVERY STORAGE AND HANDLING

- A. Do not deliver interior finish carpentry materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

PART 2 – PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each “Sustainability Focus Material” in accordance with Section 018113 Appendix A and Appendix B.

2.2 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General: Materials, as fabricated and installed, shall comply with specified quality grades of AWI/AWMAC/WI *Architectural Woodwork Standards*.
 - 1. All board products shall be S4S, except as otherwise specified.
- B. Panel Products: Composite panel products and plywood shall be “no added urea-formaldehyde”, including all concealed components.
 - 1. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheat board and strawboard and similar manufactured products.
- C. Moisture content:
 - 1. Wood for interior use shall have a moisture content between 5 and 10 percent, when delivered to the project.

2.3 BOARD AND PANEL MATERIALS

- A. Interior trim to receive paint (opaque finish): Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI “Architectural Woodwork Standards,” latest edition for specified quality grades, (as installed). Acceptable wood species are limited to the following:
 - 1. Yellow Poplar (*Liriodendron tulipifera*), Plain Sawn, clear straight-grained, C-Select or better.
 - 2. Natural Birch” Yellow Birch (*Betula alleghaniensis*), Plain Sawn.

3. Natural Maple (*Acer saccharum*), Plain Sawn.
- B. Interior trim scheduled to receive transparent finish: Furnished under Section 06 40 00 – ARCHITECTURAL WOODWORK
- C. Plywood and panel products:
1. Shelving to receive paint: APA graded A-A INT, touch-sanded, 3/4 inch thick with 3/8 inch hardwood edge banding at all edges.
 2. Engineered panels scheduled for opaque finish: Medium Density Fiberboard (MDF) of thickness indicated on the Drawings, conforming to ANSI A208.2 product class MD, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m³). Acceptable products include the following or approved equal:
 - a. Flakeboard, Toronto, Ontario, Canada, product: “Superior MDF”.
 - b. SierrePine Inc., Moncure, NC, product “Medite II”.
 - c. Plum Creek Timber Company Inc., Seattle, WA, product “Standard MDF”.
 3. Exposed plywood for painted finish: Medium Density Overlay (MDO) resin-fiber overlay plywood with exterior grade glue, 5/8 inch thick or thickness(es) otherwise indicated on the Drawings, APA rated: MDO B-B G-2 EXT.
- D. Stage flooring: Double (service) tempered hardboard fabricated from inter-felted lingo-cellulosic fibers consolidated under heat and pressure complying with ANSI A135.4, minimum 1/4 inch thick fabricated in sheets 4 feet by 4 feet factory primed and finished.
1. Provide products complying with the following minimum characteristics:
 - a. Density: 58 lbs/ft³ when testing in accordance with ASTM D 1037.
 - b. Modulus of rupture: 5,000 lbs/in² when testing in accordance with ASTM D 1037.
 - c. Water absorption: 28 percent when testing in accordance with ASTM D 1037.
 2. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Georgia Pacific Building Products, Atlanta, GA.
 - b. Decorative Panels International, Toledo, OH.
 3. Vapor retarder: 6 mil thick black polyethylene sheeting and 2 inch wide waterproof sealing tape for joints.
 4. Resilient pads: 2 inch by 2 inch by 3/4 inch thick neoprene or EPDM, 40-50 durometer hardness, maximum allowable deflection 1/8 inch.
 5. Wood sleepers and plywood subflooring: Refer to Section 06 10 00 – ROUGH CARPENTRY.

2.4 SEAMLESS RESILIENT TACKBOARDS

- A. Tackboard surfacing: 1/4 inch thick seamless linoleum composite self-healing bulletin board, with solid color through-out material. Surface shall be self-healing

and have a washable satin-matte finish. Color(s) as selected by Architect from manufacturers full available library of colors, up to 4 colors may be selected.

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Forbo North America Richmond VA, Product: " Forbo Bulletin Board"
2. Acceptable manufacturers include the following or approved equal:
 - a. Forbo North America.
 - b. Koroseal.
 - c. Walltalkers
 - d. Claridge Products and Equipment, Inc.

2.5 CLOSET AND SHELVING HARDWARE

- A. Metal closet rods and brackets:
 1. Closet pole: 0.087 inch (2.21 mm) wall thickness steel tubing, 1-1/16 inch diameter, of custom cut lengths required for full width of closet, chrome finish.
 - a. Provide intermediate supports for span lengths greater than 48 inches.
- B. Adjustable shelving, wall mounted standards and brackets:
 1. Acceptable manufacturers, include the following, or approved equal:
 - a. Knappe & Vogt, Grand Rapids MI.
 - b. Spur Systems International Limited.
 - c. Reeve Store Equipment Company (ReeveCo), Pico Rivera CA.
 2. Standards (uprights): 14 gage double tracked uprights.
 - a. Locate uprights no greater than 24 inches on center.
 3. Brackets: 14 gage formed brackets,
 - a. Depth (typical): 270mm (10-1/2 inch depth), or as otherwise indicated on Drawings.
 4. Standards and brackets finish: Thermoset TGIC powder coat finish, in custom color matching Architect's control sample.

2.6 ACCESSORIES AND HARDWARE

- A. Glue for lamination and fabrication of wood, plywood and particle board items: Exterior Grade, phenolic resin glue.
- B. Nails:
 1. Nails for interior trim items: 6d and 8d coated or galvanized finish nails, except as otherwise specified herein.
- C. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use.
- D. Bolts, nuts, washers, blind fasteners, lags: Galvanized, of size and type to suite application as indicated in the drawings.
- E. Paint for back-priming:

1. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
2. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
3. Moore: "Alkyd Enamel Underbody", N°. 217.
4. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
5. Sherwin-Williams: "Wall and Wood VOC Primer", B49 WZ2 Series.

2.7 WOOD TREATMENTS

- A. Comply with requirements specified under Section 06 10 00 - ROUGH CARPENTRY.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Prime all wood surfaces of items or assemblies to be in contact with cementitious and masonry materials, prior to installation.

3.3 INSTALLATION – GENERAL CARPENTRY

- A. Install work in accordance with AWI/AWMAC/WI "*Architectural Woodwork Standards*" for specified quality grades, except that all standing and running trim joints shall be field mitered and fitted.
- B. Dress and sand woodwork until free from machine and tool marks, abrasions, raised grain, or other defects that will show through the finish on surfaces exposed to view. Wherever possible, carry out sanding on a shop belt sander, not in the field. Sandpaper field joints and leave in perfect condition for finishing.
- C. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point. Joints shall be glued tight and so formed as to conceal shrinkage. Cope trim at returns and miter at corners to produce tight-fitting joints with full surface contact throughout length of joint.
- D. Make a minimum of splices and joints in running trim, and where such splices and joints occur, fasten securely, with all exposed surfaces having smooth, continuous planes. Stagger joints in adjacent or relate members. Use scarf joints for end-to-end joints.
- E. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.
- F. All nails in interior finished work shall be blind nailed wherever possible. Nail trim with finish nails only, set using appropriate nail punch and fill with matching wood

filler. Sand smooth wood filler. Do not fasten trim with screws or bolts unless otherwise directed, or is to be subsequently covered with smaller trim.

- G. Woodwork shall be properly framed, closely fitted and accurately set to the required lines and levels and shall be rigidly secured in place. Shim as required using concealed shims to achieve specified tolerances.
- H. Cover exposed edges of plywood shelving with 3/8 inch hardwood edging. Width of edging to match thickness of shelving.

3.4 INSTALLATION TACKBOARD SURFACING

- A. Comply with manufacturer's recommended procedures and instructions for installation of tackboard surfacing and the following:
 - 1. Measure, score and cut material with sufficient overlap. Underscribe seams and cut on bevel.
 - 2. Apply adhesive to substrate using recommended notched trowel. Clean and remove foreign material from backing of Bulletin Board Material. Set and press tackboard surfacing into wet adhesive. Roll roll firmly through the width then the length with hand roller.
 - a. Do not reverse sheets.
 - 3. Remove adhesive residue immediately with a damp clean white cloth
 - 4. Install cuts and rolls in consecutive order (ensure all material is from the same production or batch number).

3.5 INSTALLATION - PREFABRICATED PRODUCTS INSTALLED UNDER THIS SECTION

- A. Do not commence installation of products until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Install products absolutely level and in true line, with units securely anchored to the surrounding construction.
- D. Remove all tape and other packing materials; thoroughly clean and polish all exterior and interior surfaces.
- E. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.6 TOLERANCES

- A. Maximum variation for wood work from true position of 1/8 inch in 8 feet for plumb and level and with a maximum of 1/16 inch offsets in adjoining surfaces intended to be flush.

3.7 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.

- B. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Remove protective material from pre-finished surfaces.

3.8 PROTECTION

- A. During the operation of finish carpentry, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

End of Section

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Section 06 40 00
ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of shop fabricated millwork and architectural woodwork where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Plastic laminate casework ('semi-custom' cabinets at Science areas, and 'custom' cabinets at Administrative and Media areas), fixed-in-place:
 - a. Wall cabinets.
 - b. Base cabinets.
 - c. Tall cabinets.
 - 2. Plastic laminate countertops and backsplashes.
 - 3. Plastic laminated sink skirts.
 - 4. Plastic laminate wall and corner panels with wood edging.
 - 5. Plastic laminated-sloped-top and side panels at lockers.
 - 6. Plastic laminated bench(es).
 - 7. Plastic laminated angled panels at drinking fountains.
 - 8. Plastic laminated projector enclosure and partial height wall paneling in Auditorium.
 - 9. Display cases.
 - a. Install glass furnished under Section 08 80 00 at display cases.
 - 10. Counter and bench supports for millwork.
 - 11. Wood veneered Auditorium "Clouds", with backing supports and suspension hardware.
 - 12. Ornamental metals integral with casework, furniture, and accessory items furnished under this Section.
 - 13. Lighting fixtures, lamps, light-reflecting and light-diffusing components, including wiring and ballasts for lights built into casework and furniture.
 - 14. Exposed blocking and blocking concealed by the work of this Section required for the installation of architectural woodwork.

15. Hardware for work of this Section, including custom fabricated hardware and accessories.
 16. Sealant, for joints between countertops, cabinets and abutting wall and partition surfaces.
- C. Furnish the following products to be installed under the designated Sections:
1. Plastic laminate shelves (for wall mounted adjustable shelving) for installation under Section 06 20 00 - FINISH CARPENTRY.
 2. Plastic laminate window stools, for installation under Section 06 20 00 - FINISH CARPENTRY.
 3. Wood trim having shop-applied transparent finish, for installation by Section 06 20 00 - FINISH CARPENTRY.
 4. Wood paneling, for installation by Section 06 20 00 - FINISH CARPENTRY.
- D. Install the following products to be furnished under the designated Sections:
1. Tempered glass doors and shelves for display cases furnished under Section 08 80 00 – GLAZING.
- E. Make all cut-outs within casework items as required to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.
- F. Provide glass shelving and perform shop-glazing of casework, furniture and accessories items fabricated by this Section.
- G. No attempt is made in this Section to list all elements of architectural woodwork required on this project or to describe how each element will be installed. It is the responsibility of the Contractor to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- D. Section 06 20 00 - FINISH CARPENTRY:
1. Fixed wood shelving and trim.
 2. Installation of wood door frames furnished under this Section 06 40 00
 3. Installation of wood interior and exterior trim furnished under this Section 06 40 00.
 4. Interior and exterior wood trim.
 5. Installation of panels for refrigerators.

- E. Section 06 61 16 - SOLID SURFACING FABRICATIONS:
 - 1. Solid surfacing material countertops.
 - 2. Fabricated solid polymer trim at plastic laminate counters, and where shown on the Drawings.
- F. Section 08 80 00 – Glazing: Furnish glass for installation in display cases.
- G. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work.
- H. Section 09 29 00 - GYPSUM BOARD: Wall board construction work, having taped and compounded joint finish.
- I. Section 11 31 00 - RESIDENTIAL APPLIANCES.
- J. Division 22 - PLUMBING: Plumbing fixtures and piping.
- K. Division 26 - ELECTRICAL: Electrical connections for lighting.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 523 - Standard Specification for Specular Gloss.
 - 2. AWI Quality Certification Program.
 - 3. FSC (Forest Stewardship Council): "FSC Certification Program"
 - 4. ANSI/HPVA HP-1 – American National Standard for Hardwood and Decorative Plywood.
 - 5. APA Grades and Specifications.
 - 6. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.
 - 7. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
 - a. PS-1 - Construction and Industrial Plywood Standard. (on 3/2018 this is still current)
 - b. PS-20 - American Softwood Lumber Standard.
 - 8. AWPA C-27 - Plywood, Fire Retardant Treatment by Pressure Processes.
 - 9. MIL L-1914OE - Lumber and Plywood, Fire Retardant Treated.
 - 10. UL - Building Materials Directory.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. AWI/AWMAC/WI joint publication: *North America Architectural Woodwork Standards*, version 3.1, as amended by published errata, referenced herein as NAAWS.

- C. Definitions:
1. AWI: American Woodwork Institute.
 2. AWMAC: Architectural Woodwork Manufacturers Association of Canada, Alberta, Canada.
 3. FSC: Forest Stewardship Council.
 4. HPVA: Hardwood Plywood & Veneer Association.
 5. WI: Woodwork Institute.
 6. NAUF: No added Urea Formaldehyde.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. At least two weeks before scheduled delivery of woodwork, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Architect, Contractor, installers of woodwork, woodwork fabricator representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - a. Section 06 20 00 - FINISH CARPENTRY
 - b. Section 08 71 00 - DOOR HARDWARE.
 - c. Section 08 80 00 – GLAZING.
 - d. Section 09 29 00 - GYPSUM BOARD.
 - e. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
 2. Agenda:
 - a. Scheduling of woodwork operations.
 - b. Review of staging , material storage locations and temporary protection of stored items.
 - c. Ambient conditioning and environmental controls.
 - d. Coordination of related work.
 - e. Protection of installed woodwork.
 3. Delivery and installation of woodwork may only proceed when everyone concerned agrees that required ambient conditions can be maintained.
- B. Sequencing:
1. Field Measurements: Where possible the woodwork manufacturer shall take field measurements before preparation of shop drawings and fabrication to ensure proper fitting of Work.
 - a. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 2. Field dimensions which are not controlled by Project conditions: The woodwork manufacturer is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 - a. The Contractor shall acknowledge the woodwork fabricator's need for accurate field dimensions prior to custom fabrication.

- b. The Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

C. Scheduling:

- 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following in compliance with AWI/AWMAC/WI *NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS* (NAAWS), version 3.1, Section 1 – Submittals. and as specified under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

- 1. Product Data: Manufacturer's product data sheets, specifications, performance data, for each item furnished hereunder, including, but not limited to: Fastenings, adhesives, hardware, and accessories.
 - a. Provide additional information required for fillers and finish products: Include, chemical, functional, and environmental characteristics, limitations and special application requirements. Identify available colors, shades, and gloss.
- 2. Shop drawings bearing dimensions of actual measurements taken at the project, include at least the following, which are in addition to shop drawing requirements described in NAAWS:
 - a. 1/4 inch scale elevations and plans of each casework item.
 - b. Large scale design details of minimum 1-1/2 inch to 1-foot scale, showing abutting materials, installation conditions, clearances. Show woodwork profiles, jointing and fastening methods; details of drawers and doors.
 - c. Full size or half-full size sections, showing individual components, profiles and jointing.
- 3. Selection Samples:
 - a. Plastic laminate chips for initial color selection by Architect.
 - b. Melamine chips for initial color selection by Architect.
 - c. Chain of PVC edging materials.
 - d. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - e. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
- 4. Verification Samples:
 - a. 12 by 12 inch samples of wood veneer illustrating maximum range of color variations and applied transparent shop finish.
 - b. 12 inch long samples of solid hardwoods illustrating maximum range of color variations and applied transparent shop finish.
 - c. 12 by 12 inch samples of glass shelving, and glass for casework fronts.
 - d. 12 inch length glazing door rail.

- e. 12 by 12 inch samples of plastic laminate (of each color required for project).
 - f. 12 inch length samples of plastic edging material (of each color required for project).
 - g. 12 by 12 inch samples of Melamine board.
 - h. One each of all cabinet hardware. (approved cabinet hardware samples will be returned to Contractor and may become part of the Work).
5. Certificates:
- a. Certify that all composite wood and agrifiber products used on this Project are NAUF.
 - 1) Written certification from Millworker, that only “no-added formaldehyde” (NAUF) manufactured composite panel products are to be incorporated into the Work, including all concealed components. NAUF composite panel products include, but are not limited to, particle board (PB), oriented strand board (OSB), and medium density fiberboard (MDF) and similar manufactured products.
6. Manufacturer’s Instructions: Provide installation instructions and templates for hardware and field applied items.

1.7 QUALITY ASSURANCE

- A. Quality Standards: All materials, workmanship and finishes shall meet AWI/AWMAC/WI AWI/AWMAC/WI *NORTH AMERICAN ARCHITECTURAL WOODWORK STANDARDS* (NAAWS), version 3.1, as amended by published errata, for “Premium” Quality Grade.
- B. Qualifications:
 - 1. Fabricator/Installer: AWI member specializing in architectural woodwork of type specified herein having a minimum of 5 years documented experience.
- C. Pre-installation off-site Inspection of Work: The Architect reserves the right to make visits to the millworker’s facility by pre-arrangement during fabrication of the Work.

1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Mockups: Before fabricating and installing interior architectural woodwork, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
 - 2. Notify Architect seven days in advance of dates and times when mockups will be [fabricated] [and] [installed].
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting interior architectural woodwork fabrication.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Locate mock-ups where directed and include all surfaces and materials scheduled to receive a field applied finish.
- D. Accepted mock-ups may [not] remain as part of the work; the number of mock-ups shall not be restricted. Demolish and remove mockups when directed.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. General: The woodwork manufacturer, woodwork installer and the Contractor are jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in ambient humidity and relative moisture content.
 2. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of woodwork items.
 3. Sequence deliveries to avoid delays and to minimize on-site storage.
- B. Storage and Handling Requirements:
1. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.

1.10 SITE CONDITIONS

- A. Temperature: Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, and during installation of architectural woodwork; maintain temperature after installation until Owner's Final Acceptance.
- B. Relative Humidity: Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, and during, installation of architectural woodwork: maintain relative humidity after installation until Owner's Final Acceptance.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.2 WOOD MATERIALS – GENERAL REQUIREMENTS

- A. General requirements:
1. Solid wood components: New, dressed four sides (S4S), and free from warping and other defects.

2. Panel Products: Composite panel products and plywood shall be “no added urea-formaldehyde”, including all concealed components.
 - a. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF), wheatboard and strawboard and similar manufactured products.
 3. Moisture Content:
 - a. Solid hardwood(s) scheduled for transparent finish: Moisture content shall not exceed 8 percent when delivered to Project.
 - b. Typical (hardwood and softwoods): Moisture content of wood shall be between 5 and 10 percent when delivered to the project.
- B. Wood Species:
1. Exposed wood scheduled for transparent finish (for tops, tack board frames, and edge trim), meeting NAAWS Premium Grade Standards (as installed).
 - a. Wood species and cut: Select White Maple (*Acer saccharum*) {sapwood}, Quarter Sliced.
 - b. Wood shall color match specified veneer, and be clear without knots, and other natural defects.
 2. Exposed wood scheduled for opaque finish (for frames, shelves, fillers, edge trim, drawer construction and additional conditions indicated): Wood shall be clear without knots or surface defects. and conform to AWI/AWMAC/WI “Architectural Woodwork Standards,” latest edition, for PREMIUM GRADE, as installed. Acceptable wood species are limited to the following:
 - a. Natural Birch” Yellow Birch (*Betula alleghaniensis*), Plain Sliced/Sawn.
 - b. Natural Maple (*Acer saccharum*), Plain Sliced/Sawn.
 - c. Yellow Poplar (*Liriodendron tulipifera*), Plain Sliced/Sawn, clear straight-grained, C-Select or better.
- C. Veneered panels for transparent finish: The face veneer for transparent finishes shall be minimum 1/28 inch thick on doors, shelves, panels and other exposed surfaces meeting AWI Premium Grade Standards (installed). Each exposed face shall be of tight smooth veneer with joints parallel to vertical edges with no sharp contrasts.
1. Wood Species: Select White Maple (*Acer saccharum*) {sapwood}, Quarter Sliced, Grade A.
 2. Matching of adjacent pieces of veneer: book matched.
 3. Panel face assembly: Running.
- D. Panel Products:
1. Auditorium Clouds:
 - a. Shop primed, field finished: APA B-B PLUGGED EXT, fir plywood, sanded.
 - b. Wood veneer, shop finished: Specified plywood core and veneer.
 2. Exposed plywood panels scheduled for opaque finish: Medium density overlay plywood, in thicknesses indicated in Drawings.
 3. Medium Density Fiberboard (MDF) Moisture Resistant Panels: No-Added-Urea-Formaldehyde (NAUF), of thickness indicated on the Drawings,

conforming to ANSI A208.2, Grade 155, product class MR50, fabricated from 100 percent recycled fiber, using formaldehyde free synthetic resin such as methyl diisocyanate (MDI), having a minimum density of 45 pounds per cubic foot (769 kg/m³).

- a. SCS or equivalent certified for recycled fiber content.
 - b. Acceptable products include the following or approved equal.
 - 1) Arauco (Flakeboard Brand) Bennettsville, SC, product "Vestex MR50"
 - 2) Georgia Pacific, product: "UltraStock MR+Free".
 - 3) Roseburg South Dillard, OR., product "Medex"
- E. Concealed supports for edge and corner backing shall be kiln dried birch or poplar, meeting AWI Premium Grade Standards.
- F. Blocking and furring at base and walls shall comply with American Softwood Lumber Standard PS 20-70 and with specific grading requirements of SPIB: Kiln dried (KD15), Structural Light Framing, N^o. 2 grade, free of warping and large knots.
- G. Internal concealed framing for casework: Kiln-dried, (KD15), eastern pine, poplar, eastern spruce, or southern pine, conforming to AWI Premium grade.
- H. Fir plywood for concealed from view applications in conjunction with the various casework items: APA C-C PLUGGED EXT.

2.3 PLASTIC LAMINATE FACING

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Ralph Wilson Plastics Co. (Wilsonart), Temple TX.:
1. Countertops at exterior walls: White.
 2. Wood grain: Wilsonart "Raw Chestnut," number 7975K.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Formica Corp., Cincinnati, OH.
 2. Laminart, Elk Grove Village, IL.
 3. Pioneer Plastics Corp. (Pionite), Auburn ME.
 4. Nevamar Corp., Odenton MD.
 5. Ralph Wilson Plastics Co. (Wilsonart), Temple TX.
- C. Plastic laminate, general purpose, conforming to NEMA LD3.1 -2005 Grade GP50, nominal 0.050 inch thickness, in a low non-directional texture in color price group selected by the Architect.
1. General purpose grade laminate shall be used for all exposed to view surfaces including
 - a. Exposed outward face of cabinet fronts and closure trim.
 - b. Cabinet doors (all sides).

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- c. Drawer fronts (all sides).
 - d. Interior surfaces of open cabinets (without doors).
 - e. Plastic laminated trim.
 - 2. General purpose grade laminate shall be used for counter tops except where colored core laminate is indicated.
 - D. Plastic laminate, General Purpose, High Wear Type, high-pressure plastic laminate conforming to NEMA LD3.1 -2005 Grade HDS, nominal 0.1.2mm thickness \pm .12mm, (0.048 inch, \pm 0.005 inches) in color selected by the Architect from full range of manufacturer's price groups.
 - 1. High Wear Type (NEMA Grade HDS) laminate shall be used for all exposed to view surfaces including
 - a. Exposed outward face of cabinet fronts and closure trim.
 - b. Cabinet doors (all sides).
 - c. Drawer fronts (all sides).
 - d. Interior surfaces of open cabinets (without doors).
 - e. Plastic laminated trim.
 - 2. Performance criteria:
 - a. Wear Resistance (cycles): 3,000 minimum.
 - b. Ball impact resistance: 1250 mm minimum.
 - c. Dart impact resistance: 500 mm minimum.
 - d. Boiling Water Resistance: No effect.
 - e. High Temperature Resistance: Slight effect.
 - f. Radiant Heat Resistance (coil method): 125 seconds minimum.
 - g. Stain Resistance: No effect.
 - h. Light Resistance: Slight effect.
 - E. Plastic laminate, cabinet interior grade, conforming to NEMA LD3-1985 Grade CL20, 0.020 inch nominal thickness, in a low non-directional texture in solid color price group as selected by the Architect.
 - 1. Cabinet interior grade laminate may be used for the interior surfaces of all 'closed cabinets,' where general purpose grade is not required.
 - 2. All shelving shall be cabinet interior grade.
 - F. Plastic laminate, unfinished balancing (backer) sheet, conforming to NEMA LD3-1985 undecorated laminate, Grade BK20, 0.020 inch nominal thickness.
 - G. Edging: Wood as specified herein.
- 2.4 BACKING FOR LAMINATES AND VENEERS
- A. Auditorium clouds: APA B-B PLUGGED INT, fir plywood, sanded.
 - B. Cabinetry case body, and countertops without sinks: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with ANSI/HPVA HP-1.

1. "No Formaldehyde Added": Provide board which is fabricated using pre-consumer recycled wood fibers and an exterior-grade urea-formaldehyde free resin binder. Product shall contain no formaldehyde additives. Acceptable products include the following or approved equal.
 - a. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor Particleboard Plus"
 - b. Plummer Forest Products, Post Falls ID., product "PFP particleboard".
 - c. SierrePine Inc., Martel, CA., product "Encore SDP"
 2. Thicknesses:
 - a. 3/4 inch thick at cases.
 - b. 1 inch thick at shelves under 30 inches wide.
 - c. 1 1/8 inch thick at shelves 30 inches or more wide.
 - d. 1 1/8 inch thick at counters without sinks.
- C. Backing for casework end panels which extend to floor, all window stools, all countertops with sinks and similar wet conditions: Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 44 pounds per cubic foot.
1. Acceptable products include the following:
 - a. SierrePine Inc., Moncure, NC., product "Medex".
 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated.
- D. Countertops with sinks and similar wet conditions: APA C-C PLUGGED EXT, fir plywood, sanded.
- E. Drawers and doors: Medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 45 pounds per cubic foot.
1. Acceptable products include the following or approved equal:
 - a. Canfibre Group Ltd., Toronto, Ontario Canada, product: "AllGreen MDF".
 - b. Collins Pine Company (distributed through Panel Source International, Tacoma WA.), product: "PureKor MDF Plus"
 - c. SierrePine Inc., Martel, CA., product "Medite II"
 - d. Temple Inland, Austin TX., product "UltraStock – Free."
 2. Thicknesses:
 - a. Typical: 3/4 inch thick panels, except as otherwise indicated or specified.
 - b. Doors over 36 inches tall: provide 1-1/4 inch thick panels.

2.5 CABINET HARDWARE

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:

1. Accuride Corp., Santa Fe Springs, CA.
 2. CompX International, Inc., Dallas TX.
 3. C.R. Laurence, Los Angeles, CA.
 4. Doug Mockett & Company, Inc., Manhattan Beach, CA.
 5. Engineered Products Company, Flint MI.
 6. Glynn-Johnson, Indianapolis IN.
 7. Grass America Inc., Kernersville NC.
 8. H.B. Ives Company, Wallingford CT.
 9. Häfele America Company, Archdale NC.
 10. Julius Blum, Inc. , Stanley NC.
 11. Knappe & Vogt, Grand Rapids, MI.
 12. (Lamp) Sugatsune America, Inc. Carson, CA..
 13. Mepla Inc., High Point NC.
 14. Outwater Plastic Industries Inc., Bogata NJ.
 15. Stanley Hardware, New Britain CT.
 16. Waterloo Furniture Components, Ontario Canada.
- B. Door and drawer pulls: Staple-shape wire pull, varying lengths indicated on Drawings, Medium bronze finish, with one-inch finger clearance.
- C. Locks:
1. General:
 - a. Provide at least three keys per keyed alike group.
 - b. Finish: lock plug finish "statuary bronze".
 2. Locks for drawers and doors: deadbolt type.
 3. Locks for front mounted gang locks.
- D. Catches: Magnetic.
- E. Casework (European, concealed type) hinges:
1. General; number of hinges: Provide number of hinges recommended by manufacturer for size and weight of door, but not less than the following:
 - a. Doors up to 36 inches height, or weight not to exceed 11 pounds: 2 hinges.
 - b. Doors up to 60 inches height, or weight not to exceed 20 pounds: 3 hinges.
 - c. Doors up to 72 inches height, or weight not to exceed 33 pounds: 4 hinges.
 - d. Doors up to 90 inches height, or weight not to exceed 48 pounds: 5 hinges.
 2. Hinge for full overlay cabinet doors: Self closing concealed hinge having maximum 110 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum "Soft-Close BLUMotion Clip-Top Overlay Hinge" with straight arm, model N°. 71B3550.

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- a. Maximum door thickness 1 inch (26 mm).
 - 3. Hinge for full overlay cabinet 'thick' doors: Self closing concealed hinge having maximum 95 degree angle of opening, 3 way adjustment. Hinges shall be equal to Blum "Clip-Top Overlay Hinge" with straight arm, model N°. 71T9550 with BLUMotion 'soft-close'.
 - a. Maximum door thickness 1-3/16 inch (30 mm).
 - F. Pad silencers for doors: 10 mm (3/8 inch) diameter, self-adhesive resilient plastic or nylon buttons, at least 2 per door, in clear color.
 - G. Drawer Slides (provide one pair per drawer except as noted otherwise):
 - 1. For heavy loads including credenzas, file cabinets, store fixtures, linen closets and tool drawers: Full extension type, 150 pounds per pair minimum rated capacity (for drawers over 30 inches, provide 175 pounds rated capacity), steel ball bearing rollers, drawer hold in feature.
 - a. Acceptable slides, include the following, or approved equal:
 - 1) For drawers up to 24 inches wide:
 - a) Accuride N°. 4032.
 - b) Knape and Vogt N°. 8500.
 - c) Häfele N°. 4034.
 - 2) For drawers over 24 inches and up to 30 inches wide:
 - a) Accuride N°. 4032.
 - b) Knape and Vogt N°. 8500.
 - c) Häfele N°. No equal.
 - 3) For drawers over 30 inches wide:
 - a) Accuride N°. 4437.
 - b) Knape and Vogt N°. 8520.
 - c) Häfele N°. No equal.
 - b. Finish: clear lacquered zinc.
 - 2. For desk and casework drawers (excluding file drawers): Full extension type, 100 pounds per pair minimum rated capacity, steel ball bearing rollers, lever disconnect, drawer hold in detent feature.
 - a. Acceptable slides, include the following, or approved equal:
 - 1) Accuride N°. 3832A
 - 2) Knape and Vogt N°. 8400.
 - 3) Häfele N°. 3832.
 - b. Finish: clear lacquered zinc.
 - H. Shelf supports.
 - 1. Shelf pins for laminated shelving, and wood shelving: plug-in type for 5mm diameter hole, Häfele model number 282.11.710 cast zinc alloy with nickel plated finish and recessed seat.
 - I. Wire management grommets and covers: 3 inch diameter, as manufactured by Doug Mockett & Company, Manhattan Beach CA., model number " PS-3B with cover".

1. Grommet Finish: Provide in Satin Bronze finish, except as otherwise selected by Architect for designated locations. Grommet finishes as selected from Manufacturer's standard finishes.
2. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
 - a. For counters 6 feet or less provide 2 wire grommets and covers.
 - b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.
3. Locations: Provide where shown on Drawings, and if not shown, allow the following numbers of grommets; exact locations to be determined in field.
 - a. For counters 6 feet or less provide 2 wire grommets and covers.
 - b. For counters over 6 feet, provide 1 wire grommet and cover for every 42 inches of counter, or fraction thereof.

2.6 DISPLAY CASE DOORS

- A. Hinges: C.R. Laurence, Los Angeles, CA, "Prima' Series, model "PPHO1BBRZ," top and bottom mount hinges in Satin Bronze Finish.
- B. Lock: C.R. Laurence, Los Angeles, CA, model "LK338-KA", keyed alike plunger lock.
- C. Glass: 3/8 inch thick tempered glass, provided under Section 08 80 00.

2.7 ACCESSORIES

- A. Adhesive for installation of plastic laminate: Rigid bond Polyvinyl acetate (PVA) type only.
 1. Contact cements are only permitted at countertops with sinks or similar "wet condition" areas; and field installed applications as required.
- B. Glue for lamination and fabrication of wood and plywood items: Exterior Grade, phenolic resin glue.
- C. Counter support brackets:
 1. Basis of Design: Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA., for the following models.
 - a. Model EH-1212FM for up to 18 inch deep counters.
 - b. Model EH-1818FM for up to 24 inch deep counters.
 - c. Model EH-1824FM for up to 30 inch deep counters.
 2. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to side of supporting stud and be concealed by gypsum board or other wall finish.
 3. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with:
 - a. Provide shop applied primer, ready for field finishing.
 4. Acceptable Manufacturers/products, or approved equal:

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- a. Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA, with powder coat finish.
 - b. Outwater LLC., Woodridge NY. "South Carolina" Series: CSBxx-SC-CRS with powder coat finish.
 - c. Federal Brace, Belmont NC., model "Streamline Countertop Bracket (steel). Requires separate shop priming by this Section 06 40 00.
- D. Bench support brackets:
- 1. Basis of Design: Rakks Surface-mounted Bench Supports by Rakks/Rangine Corp, Needham MA.
 - 2. Construction: Fabricated from horizontal aluminum T section and vertical aluminum L section. Vertical leg designed to attach to side of supporting stud and be concealed by gypsum board or other wall finish.
 - 3. Factory applied finishes: Exposed aluminum surfaces shall be free of scratches and other serious blemishes and be factory finished with:
 - a. Provide shop applied primer, ready for field finishing.
 - 4. Acceptable Manufacturers/products, or approved equal:
 - a. Rakks Flush Mount Counter Supports by Rakks/Rangine Corp, Needham MA, with powder coat finish.
 - b. Outwater LLC., Woodridge NY. "South Carolina" Series: CSBxx-SC-CRS with powder coat finish.
 - c. Federal Brace, Belmont NC., model "Streamline Countertop Bracket (steel). Requires separate shop priming by this Section 06 40 00.
- E. Panel fastening system: Extruded aluminum "Z" clip panel fasteners as manufactured by one of the following:
- 1. Scottvale Metal Products, Inc., Bohemia, NY.
 - 2. Monarch Metal Fabrication, Inc., Bohemia, NY.
 - 3. Brookliyn Hardware, Portland OR.
- F. Sealant, for joints between countertops and dissimilar materials: One component acetoxysilicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect.
- 1. Only use sealant and primers that comply with the following limits for VOC content:
 - a. Architectural Sealants: 250 g/L.
 - b. Sealant primer: 250 g/L
 - 2. Sealants containing aromatic solvents, fibrous talc, formaldehyde, halogenated solvents, mercury, lead, cadmium, chromium and their compounds, are not permitted.
 - 3. Subject to requirements specified herein, the following products are acceptable, or approved equal:
 - a. Dow Corning Corporation, Midland MI.; product, "786".

- b. General Electric Company, Waterford NY.; product, "Sanitary 1700".
- c. Sonneborn Building Products Inc., Minneapolis MN.; product, "Sonolastic - OmniPlus".
- d. Tremco, Beachwood OH.; product, "Proglaze".

G. Fasteners:

- 1. Concealed joint fasteners: Threaded steel.
- 2. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.

2.8 FABRICATION - GENERAL

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Coordinate the fabrication of casework with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the casework surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the casework.
- C. Shop assemble custom casework for delivery to site. Deliver in assemblies as large as possible for entrance into the designated areas. Provide for concealed job connections of adjacent units.
- D. Prepare woodwork in the shop for all necessary electrical installations.
- E. Fabricate, install and finish all work so that both sides of countertops, panels, doors, shelves and other casework are of balanced construction, to prevent warping.
- F. Cap exposed plywood, and particle board edges with solid hardwood, matching color of wood veneer panels. Apply veneer over hardwood edging in manner to show no visible lines between wood veneer and hardwood edging.
- G. Fit corners and joints hairline, secure with concealed fasteners.
- H. Finish all solid wood and plywood surfaces smooth, and free from all machine and tool marks that will show through the wood veneer or facing materials.
- I. Make all joints tight, and form to conceal shrinkage. Glue all miters having a dimension of 4 inches or more from heel to point.
- J. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.
- K. Finished work shall be free from visible adhesive and pencil marks.

2.9 FABRICATION - CASEWORK

- A. Fabricate casework in accordance with requirements of AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grades specified herein,

under the Article entitled "QUALITY ASSURANCE," and the following additional requirements:

1. Cabinets shall be in flush overlay construction, with drawer fronts and hinged doors overlapping openings a minimum of 1/4 inch all four sides.
2. Fabricate all casework scheduled for veneer finish with exposed to view grain of wood vertical or horizontal as indicated on Drawings.
3. Fabricate cabinets in integral units, each completely enclosed, without the use of common partitions.
4. Fabricate plastic laminated casework with top and bottom fillers and corner panels described as optional for Custom Grade Work in the Quality Standards.
5. Drawers:
 - a. Drawer sides and backs 1/2 inch thick solid hardwood of specified species.
 - b. Laminated drawer fronts: High density laminate over 3/4 inch specified core material. Drawer fronts shall be applied to separate drawer body component sub-front.
 - c. Wood veneer drawer fronts: body panel 1/2 inch thick solid hardwood of specified species, face panel same construction as specified for cabinet doors with matching veneer. Drawer fronts shall be applied to separate drawer body component sub-front.
 - d. Drawer bottoms (wood veneer casework): 1/4 inch thick hardwood veneer panel housed and glued into front, sides and back.
 - e. Drawer bottoms (plastic laminated casework): 1/4 inch thick color polyester laminate, housed and glued into front, sides and back.
 - f. Underside of drawer to receive continuous hot melt glue at joint between bottom and back/sides/front for sealing and rigidity.
 - g. Reinforce drawer bottoms as required with intermediate spreaders.
6. Doors: Square edge design, 3/4 inch thick, without any profiling and shall fully overlap the cabinet frame.
 - a. Laminate doors: Fabricate doors with particle board core and front and rear faces high-pressure laminate, of selected color.
 - b. Wood veneer doors: Fabricate doors with particle board core and front and rear faces grade AA wood veneer, and solid wood edging.
 - c. Maintain a maximum 1/8" reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
7. Base cabinets: Provide full horizontal top frame with glued and doweled joints, 3/4 inch plywood end panels and bottom. Bottom shall be glued and doweled and let into routed end panels. Provide 4 inch high toe rail, securely screwed to the end panels and to the bottom panel by concealed glue blocks.
8. Wall cabinets: Provide same finishes as base cabinets, with 3/4 inch thick top and bottom veneered plywood panels. Top and bottom panels shall be glued and doweled and let into routed end panels. Back of case shall be recessed and let into routed end panels and further secured with glue blocks.
9. Door and drawer spreaders: Provide minimum 3/4 thick full width cabinet body spreaders immediately behind all door/drawer and multiple drawer horizontal

joints to maintain exact body dimensions, and close off reveal. Front edge to be match face of adjacent cabinet doors/drawers.

2.10 FABRICATION - PANELING

- A. Fabrication panels as detailed with hardwood insets and articulated joints between panels, and at outside and inside corners with prominent grain horizontal Fabricate to required sizes within the following tolerances.
 - 1. Thickness: Plus or minus 1/16 inch.
 - 2. Size (dimension each side): Plus or minus 1/16 inch.
 - 3. Squareness (difference in length of two diagonal measurements): Plus or minus 1/16 inch.

2.11 FABRICATION OF PLASTIC LAMINATE CLAD ITEMS

- A. Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Except as otherwise specified hereunder, fabricate plastic laminate clad items in strict accordance with the details on the Drawings, the approved shop drawings, and workmanship standards set forth in AWI/AWMAC/WI "*Architectural Woodwork Standards*," latest edition, in grade(s) specified herein.
- C. Shop fabricate all plastic laminate clad items. Adhere plastic laminate to particle board backing sheets by cold-press-method. Use of contact cements are not permitted. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Apply laminate backing sheet to reverse side of all laminated, panels, shelving and tops.
- D. Fit corners and joints hairline. Make all joints and miters tight, secure with concealed fasteners.

2.12 SHOP APPLIED FINISHING

- A. Transparent exposed-to-view finish: AWI/AWMAC/WI "*Architectural Woodwork Standards*," Premium Grade Factory/Shop Finish System Number 2 Transparent, "Pre-catalyzed Lacquer" system having a gloss effect matching Architect's control sample.
 - 1. Basis of Design Finish: Sherwin Williams product "MagnaMax Hi-Solids Water White Pre-Catalyzed Clear Lacquer", or approved equal, as recommended by woodwork fabricator to match Architect's finished control sample. Finish system to include:
 - a. One washcoat, reduced vinyl sealer, as recommended by applicator for desired finish
 - b. Colorant, dye stain, wiping stain or spray-applied as required to match Architect's control sample.
 - c. One coat sealer: Vinyl sealer.
 - d. Sand sealer (minimum 240 grit).
 - e. First application topcoat, applied 3.0 to 6.0 mils wet.
 - f. Sand topcoat (minimum 280 to 320 grit).

- g. Second application topcoat, applied 3.0 to 6.0 mils wet.
 - h. Sand topcoat (minimum 280 to 320 grit).
 - i. Final application topcoat, applied 3.0 to 6.0 mils wet.
2. Total Dry Film Thickness not to exceed 5.0 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
 - 2. Examine pre-fabricated woodwork before installation and verify that back priming has been completed and all packing has been removed.
 - 3. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Before installing work under this section, woodwork shall be conditioned to average prevailing humidity conditions in areas of installation.
- B. Protect other Work against undue soilage and damage by the exercise of reasonable care and precautions. Clean, repair, or replace any work so damaged and soiled to the acceptance of the Architect.

3.3 INSTALLATION - GENERAL

- A. Install work in accordance with the latest AWI/AWMA/WI joint publication: *Architectural Woodwork Standards* in grade specified herein, under the Article entitled "QUALITY ASSURANCE".
- B. Woodwork shall be installed plumb, level, true and straight without distortions.
 - 1. Use concealed shims as required
 - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
 - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and woodwork shall be scribed and trimmed to fit adjoining work.
 - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure woodwork to anchors or built-in blocking or blocking directly attached to substrates.
 - 1. Secure woodwork to grounds, furring, stripping and blocking as required with countersunk, concealed fasteners and blind nailing performing a complete installation.
 - 2. Use thin gauge finishing nails for exposed nailing, countersunk and filled flush with woodwork finished surface.
 - a. Match final finish materials where transparent finish is indicated.

3.4 INSTALLATION - CASEWORK AND COUNTERTOPS

- A. Install casework without distortion so that doors and drawers fit openings properly and are accurately and evenly aligned.
- B. Adjust casework hardware centering the doors and drawers in the openings, and provide unencumbered operation.
- C. Complete the installation of hardware and accessory items as indicated.
- D. Maintain veneer sequence matching of casework with transparent finish, where so manufactured.
- E. Tops: Anchor tops securely to base units and to other support systems as required.
- F. Sealant application: Coordinate the application of joint sealant between countertops and abutting wall surfaces, provided under Section 07 92 00 – JOINT SEALERS.

3.5 INSTALLATION - WOOD PANELING

- A. Install panels as detailed with hardwood insets and articulated joints between panels, and at outside and inside corners with prominent grain horizontal. Secure paneling to supporting substrate with specified concealed panel fastening system, by blind nailing on back-up furring strips, and with similar associated trim and framing. Install panels within the following tolerances:
 - 1. Typical joint width: as detailed on the Drawings.
 - 2. Full height panels shall have 3 rows of continuous panel fasteners.
 - 3. Joint taper: Plus or minus 1/16 inch for width of each hardwood panel non-cumulative, except that taper tolerance shall not act to increase or decrease joint width tolerance.
 - 4. Maximum offset in alignment at corners: 1/16 inch.
 - 5. Step between faces of adjacent panels 1/16 inch.
 - 6. Plumbness overall of installed panel system: Plus or minus 1/8 inch in 10 feet.
- B. Face nailing will not be permitted.

3.6 FIELD FINISHING

- A. Except where expressly noted otherwise on Drawings, shop finish all woodwork. Where field finishing is indicated or scheduled on Drawings, finishing Work shall be as specified under Section 09 91 00 - PAINTING.

3.7 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.8 ADJUSTING

- A. To whatever extent work was not completed at shop or prior to installation of woodwork, perform and complete the specified finishing of woodwork.

- B. Repair damaged and defective woodwork where possible eliminating defects functionally and visually.
 - 1. Where not possible to repair damaged or defective work, replace with matching new work.
 - 2. Adjust joinery for uniform appearance.
- C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

3.9 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area leave area in broom-clean condition.
- D. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant manufacturer.
- E. Remove protective material from pre-finished surfaces, immediately prior to Final Acceptance.
- F. Carefully clean exposed and semi-exposed wood surfaces, in strict accordance with fabricator's instructions. Touch-up shop-applied finishes to restore damaged or soiled areas, matching adjoining finish.
- G. Wash down plastic laminate with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- H. Clean and polish hardware, and bright metal trim components.

3.10 PROTECTION

- A. Protect installed woodwork and maintain specified conditions, in a manner acceptable to both fabricator and installer. Ensure that work of this Section will not be damaged or soiled, and is completely free of defects at the time of final acceptance of Project by the Architect.

End of Section

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Section 06 49 23
WOOD GRILLES

PART 1 – GENERAL

1.1 SUMMARY

- A. Furnish and install wall / suspension mounted pre-fabricated linear wood sun control units, including mounting system..
- B. Factory treat all wood components with fire resistance rated transparent finish system.

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 09 29 00 - GYPSUM BOARD: drywall construction.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 641: Zinc Coated (Galvanized) Carbon Steel Wire.
 - 2. ASTM C 423: Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
 - 3. ASTM C 635: Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 4. ASTM C 636: Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels..
 - 5. ASTM E 84: Surface Burning Characteristics of Building Materials.
 - 6. ASTM E 580: Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
 - 7. AWI (QSI): Architectural Woodwork Quality Standards Illustrated; 2003.
 - 8. CISCA: Ceiling Systems Handbook.
 - 9. UL: Fire Resistance Directory and Building Material Directory.
 - 10. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.
- B. The following reference materials are hereby made a part of this Section by reference thereto:

1. Ceilings and Interior Systems Contractors Association (CISCA) - Acoustical Ceilings: Use and Practice.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Shop drawings: Indicate grid layout, direction and spacing of wood slats and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
 3. Certification: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this SECTION; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 4. Verification samples:
 - a. 12 inch length linear wood units, illustrating grade of wood and finish treatment.
 - b. 12 inch long samples of suspension system components.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver linear wood ceiling tile in original, unopened packages and store protected in a fully enclosed space.

1.6 ENVIRONMENTAL CONDITIONS

- A. Maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
 1. Coordinate work of this Section 09 54 26, with electrical and mechanical ceiling installation. Ensure all electrical and mechanical work is supported independently of the wood ceiling system
- B. Sequence work to ensure wood ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead work is completed, tested and approved.
- C. Install ceiling system after interior wet work is dry.

PART 2 - PRODUCTS

2.1 LINEAR WOOD SLAT SUN CONTROL SYSTEM

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Rulon International, St. Augustine, FL., product "Wood Panel Grilles." Model PG-4-12-60.
 - 1. Acceptable Manufacturers and ceiling systems: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Norton Industries, Lakewood, OH., product: "Wood Grille Dowel Panels."
 - b. Rulon International, St. Augustine, FL., product "Wood Panel Grilles."
 - c. Armstrong World Industries, Inc., Lancaster, PA., product "Woodworks Grille."
- B. Linear wood slats: factory treated with fire protective coating and continuous rabbeted edges for insertion of hanging clips.
 - 1. Slat Spacing: manufacturer's standard, minimum 70% open (nominal 3-3/8 inch).
 - 2. Wood species / Manufacturer:
 - a. Rulon: White Oak
 - 3. Edge profile: square edge.
 - 4. Finish: Match Architect's Control Sample, Class B rating.
 - a. Top surface of horizontal slats to be factory or shop painted white.

2.2 FACTORY FINISHING

- A. Treat wood slats with transparent intumescent, satin gloss finish polyurethane varnish fire protective coating system with a fire hazard classification of Class "A", flame spread rating of 25 or less, smoke developed, and fuel contributed, with no sign of progressive combustion when the 10-minute test is continued for an additional 20 minutes.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding with installation.

- B. Permit linear wood slats to reach room temperature and a stabilized moisture content prior to installation.

3.3 INSTALLATION

- A. General: Install all materials in strict accordance with ceiling manufacturer's printed instructions. The contractor will additionally comply with applicable regulations and industry standards.
- B. Install suspended grid system in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed $1/360$ span of 48-inch simple span.
- C. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each tee member.
 - 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
 - 2. Install hanger wire to attachments with triple twists.
- D. Install tees perpendicular to the intended wood slat direction, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.
- E. Install linear wood slats in place, free from damaged edges or other defects detrimental to appearance and function. Installation shall proceed, in sequence, from one wall to the opposite side.

3.4 TOLERANCES

- A. Install ceiling system level, in uniform plane, and free from twist, warp or dents. Maximum variation from flat and level surface: $1/8$ inch in 10 feet.

3.5 CLEANING

- A. Properly clean wood slats free from dirt and handling marks.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 06 61 16
SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Solid surface (solid polymer) countertops and integral sinks.
 - 2. Sealant, for joints between countertops, backsplashes and abutting surfaces.
- B. Make all cut-outs within solid surfacing items as required to accommodate sinks, and other plumbing fixtures, from templates provided by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and nailers.
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK: Cabinetry, shelving and other shop fabricated casework.
- E. Division 22 - PLUMBING: Plumbing fixtures and piping.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data. Identify available colors, shades, and gloss
 - 2. Shop drawings: Large scale design details of minimum 1-1/2 inch-to-1 foot scale, showing abutting materials, installation conditions, clearances. Show profiles, jointing and fastening methods.
 - 3. Selection samples:
 - a. Solid surfacing samples for initial color selection by Architect.

- b. Sealant material: Manufacturer's standard strips of sealant, in all available colors, for selections by the Architect.
 - c. Provide additional samples as requested by Architect for initial selection of material colors and finishes.
4. Verification samples:
- a. 12 by 12 inch samples of solid surfacing materials.

1.5 QUALITY ASSURANCE

- A. Fabricator and Installer; with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 - 1. Fabricator and Installer for solid surfacing products shall be trained and certified by solid surfacing manufacturer.

1.6 PRE-INSTALLATION CONFERENCE

- A. Fabricator and Installer of the Work of this Section is required to attend pre-installation conference specified under Section 06 40 00 - ARCHITECTURAL WOODWORK.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of fabricated solid surface items.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.
- C. Sequence deliveries to avoid delays and to minimize on-site storage.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of solid surfacing fabrications; maintain temperature until Owner's Final Acceptance.

1.9 FIELD MEASUREMENTS

- A. Field dimensions: The fabricator is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 - 1. The Contractor shall acknowledge the fabricator's need for accurate field dimensions prior to custom fabrication.
 - 2. The Contractor and the fabricator shall cooperate to establish and maintain these field dimensions.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on E. I. du Pont de Nemours and Company, Inc., Wilmington DE product, "Corian".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Aristec Acrylics LLC (Avonite Surfaces), Florence, KY., product "Avonite".
 - 2. E. I. du Pont de Nemours and Company, Inc., Wilmington DE product, "Corian".
 - 3. Formica Corporation, Cincinnati, OH, product: "Solid Surfacing".
 - 4. LG Hausys America, Inc., Adairsville, GA., product "HI Macs"
 - 5. Wilsonart International, Inc. Temple TX, product "Solid Surfaces"

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 SOLID SURFACING MATERIALS

- A. Polymer solid surfacing material: Non-porous surfacing material homogeneously composed of natural minerals and high-performance polymer, fabricated sizes and profiles as shown on the Drawings, in colors and finishes as selected by Architect.
 - 1. Solid surfacing material shall be NSF (National Sanitation Foundation) listed under publication 51 - Plastic Materials and Components used in Food Equipment and bear the "component" mark.
 - 2. Colors and patterns shall be as selected by the Architect.
- B. Sheet thicknesses shall be as specified below or as otherwise indicated on Drawings.
 - 1. Countertops: One piece monolithic design 1/2 inch thick with solid plywood backing.
 - 2. Backsplashes: 1/2-inch thick in locations and heights as shown on the Drawings.
- C. Sinks Undermount-design bowls having square edge top. Bowl size and depth as indicated on Drawings. Color shall match counter.

2.4 ACCESSORIES

- A. Plywood backing for countertops: APA C-C PLUGGED EXT, fir plywood, sanded, thickness as indicated on Drawings.
- B. Adhesive for build-up of solid surfacing sheets: color matched two-component seam adhesive as provided by solid surfacing manufacturer.
- C. Adhesive for installation of trim components, neoprene panel adhesive or structural silicone glazing sealant, as recommended by solid surfacing manufacturer.
- D. Sealant, for joints between countertops and dissimilar materials: One component acetoxysilicone rubber, mildew resistant, FS TT-S-001543A, Type Non-Sag, Class A, and FS TT-S-00230C, Type II, Class A and ASTM C 920, Type S, Class 25, Grade NS, use NT, G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, in manufacturer's standard colors as selected by the Architect, equal to one of the following:
 - 1. Dow Corning Corporation, Midland MI.; product, "786".
 - 2. General Electric Company, Waterford NY.; product, "Sanitary 1700".
 - 3. Sonneborn Building Products Inc., Minneapolis MN.; product, "Sonolastic - OmniPlus".
 - 4. Tremco, Beachwood OH.; product, "Proglaze".
- E. Bolts, nuts, washers, lags, pins, and screws: Of size and type to suit application chrome finish in exposed-to-view locations.
- F. Concealed supports for edge and corner backing shall be kiln dried birch or poplar.

2.5 FABRICATION

- A. Coordinate the fabrication of solid surfacing products with that of the various trades responsible for installing materials and items which will be inserted into, or applied to, the countertop surfaces. Obtain and verify templates, dimensions, and instructions from the respective trades before making cut-outs, holes, slots, and other cutting in the countertops.
- B. Shop fabricate all solid surfacing items in strict accordance with the details on the Drawings, the approved shop drawings, and recommendations of the solid surfacing manufacturer
 - 1. Shop install sinks using seamed undermount design, ensure edges of sink are smooth and flush with counter; lipped design is not acceptable.
 - 2. Prepare solid surfacing fabrications for installation of plumbing fixtures.
- C. Fit corners and joints hairline. Make all field joints and miters tight, secure with concealed fasteners.
- D. Provide shop fabricated counters, shop mitered components, closure trims with ample allowance for field cutting and fitting. Provide additional trim as required for scribing and site cutting.

- E. Route all edges to be butted for a smooth, clean fit. Sand edges with 120 grit sandpaper to rough up surfaces for adhesive bonding. Clean with denatured alcohol.
- F. Prepare and apply adhesive in compliance with manufacturer's written instructions. Clamp all components using manufacturer's approved clamping methods at all joints and build-up laminations, maintain clamping until adhesive is set. Avoid over-tightening clamps and squeezing out adhesive.
- G. Remove excess adhesive when dry with router. Follow with belt sander using 120 grit, diagonal to joint. After adhesive is leveled and smooth with surface, proceed with final shaping and finishing.
- H. After shaping, smooth finish of cut surfaces equal to manufacturer's original finish. Sand surfaces smooth with wet 400 grit sandpaper. Remove superficial scratches and sander markings, buff with nylon buffing pads as recommended by solid surfacing manufacturer. Wipe surfaces clean and dry with cloths.
- I. Finished work shall be free from visible adhesive and pencil marks.
- J. Field touch-up: Shall be the responsibility of the installer and shall include the filling, and touch-up of exposed job made nail or screw holes, refinishing of surfaces resulting from job fitting, repair of job inflicted scratches and marks, and final cleaning up of the finished surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. General: Install work in accordance with manufacturer's instructions.
- B. Solid surfacing shall be installed plumb, level, true and straight without distortions:
 - 1. Use concealed shims as required
 - 2. Work shall be installed to a tolerance of 1/8 inch in 8 feet for plumb and levelness, including tops.
 - 3. There shall be no variations in flushness of adjoining surfaces.
- C. Tops and trim shall be scribed and trimmed to fit adjoining work.
 - 1. Where cuts occur, refinish surfaces and repair damaged finishes
- D. Secure solid surfacing fabrications to blocking directly attached to substrates.
 - 1. Secure fabrications using concealed fasteners.
 - 2. Anchor tops securely to base units and to other support systems as required.
- E. After installation and leveling of solid surfacing fabrications has been completed; apply a continuous bead of specified sealant to all joints which abut walls or partitions. Tool the sealant to a uniformly dense surface, level with the edges of the casework. Immediately remove all excess sealant from solid surfacing surfaces.

3.2 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.3 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps.
- B. Clean excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and solid surfacing manufacturers.
- C. Wash down exposed surfaces with a solution of mild detergent in warm water, applied with soft clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

3.4 PROTECTION

- A. Protect installed fabrications in a manner acceptable to fabricator and installer, which shall ensure no damage or deterioration at the time of Final acceptance of Project by the Architect.
- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

Section 07 00 01
WATERPROOFING, DAMPPROOFING AND CAULKING
TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
1. Specification requirements for Trade Contract "WATERPROOFING, DAMPPROOFING AND CAULKING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 07 00 01 – Waterproofing, Dampproofing and Caulking Trade Contract Requirements.
 - b. Section 07 11 13 - Bituminous Dampproofing.
 - c. Section 07 16 13 - Polymer Modified Cement Waterproofing.
 - d. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.
 - e. Section 07 92 00 - Joint Sealants.
- B. Submit bid as directed by and in compliance with the Request for Bids, the Instructions to Bidders, and this Article 1.2.
- C. Submit bid on the bid form provided in the Project Manual.
- D. Submit bid in a sealed envelope in the manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- E. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Trade Contract, unless specifically called out otherwise, regardless of where among the Drawings it appears:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A104, A200, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, A230, A300, A301, A311, A312, A313, A314, A315, A316, A317, A318, A319, A320, A321, A322, A440, A441, A442, A450, A451, A452, A453, A460, A461, A462, A463, A503, A510, A511, A512, A513, A514, A515, A520, A521, A522, A523, A524, A530, A531, A532, A533, A544, A570, A603, A605, A710, A711, A713, A714, S302, A100, A401, A501, A502, A606, A700, L 1.0, L 1.1, L 1.2, L 1.3, L 1.4, L 1.5, L 1.6, L 3.0, A181, A181A, A181B, A181C, A181D, A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A222, A402, A403, A404, A405, A406, A410, A411,

A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A426, A427, A428, A429, A430, A431, A432, A433, A434, A435, A470, A471, A472, A473, A480, A490, A491, A542, A543, A600, A601, A602, A604, A609, A620, A621, A623, A625, A650, A651, A652, A690, A802, VT01, A141A, A141B, A141C, A141D, A142A, A142B, A142C, A143A, A143B, A143C, A221, A400, A540, A541, A560, A607, A622, A691, A712, A715, A801, FS100, FS101, FS102, FS103.

2. The complete List of Drawings for the Project is provided on the Drawing Cover Sheet.

- F. Refer to Section 01 23 00 - Alternates, for Bid alternates which may affect the scope of Work of this Section.
- G. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
 - 1. None Required.
- H. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(G), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of MGL c. 149, §§ 44A-J.
- I. The BIDDING REQUIREMENTS, CONTRACT FORMS, and Contract Conditions as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.4 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.
- B. Installer of the Work of this trade is required to attend pre-installation conferences specified under the following specification sections:
 - 1. Section 00 00 00 - TITLE.

1.5 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 07 00 02

ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section is work of a Publicly Bid Trade Contractor and includes the following requirements:
1. Specification requirements for Trade Contract "ROOFING AND FLASHING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 07 00 02 - ROOFING AND FLASHING Trade Contract REQUIREMENTS.
 - b. Section 07 54 19 - POLYVINYL-CHLORIDE (PVC) ROOFING
 - c. Section 07 62 00 - SHEET METAL FLASHING AND TRIM
 - d. Section 07 72 00 – ROOF ACCESSORIES.
 - e. Section 07 72 36 – SMOKE VENTS.
- B. Submit bid as directed by and in compliance with the Request for Bids, the Instructions to Bidders, and this Article 1.2.
- C. Submit bid on the bid form provided in the Project Manual.
- D. Submit bid in a sealed envelope in the manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- E. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Trade Contract, unless specifically called out otherwise, regardless of where among the Drawings it appears:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A104, A200, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, A230, A300, A301, A311, A312, A313, A314, A315, A316, A317, A318, A319, A320, A321, A322, A513, A520, A521, A522, A523, A524, A530, A531, A532, A544, A570, A605, A714, A501, A502, A222, A470, A480, A490, A491, A542, A543, A802, A221, A540, A541, A560, A002, A492, FP001, FP104, P001, P104, M104, M408, E204, E504.
 2. The complete List of Drawings for the Project is provided on the Cover sheet of Drawings.
- F. Refer to Section 01 23 00 - Alternates, for Bid alternates which may affect the scope of Work of this Section.

- G. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
 - 1. None Required.
- H. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(G), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of MGL c. 149, §§ 44A-J.
- I. The BIDDING REQUIREMENTS, CONTRACT FORMS, and Contract Conditions as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.4 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.
- B. Pre-Installation Meeting for Roofing and Flashing Work: Conduct a pre-installation conference at the Project Site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
 - 1. Meeting Scheduling: Coordinate time of meeting to occur not less than three (3) full weeks prior to commencement of on-site roofing and flashing work; coordinate with associated trades and general construction.
 - 2. Required attendees:
 - a. Owner's Project Manager (OPM).
 - b. Architect.
 - c. General Contractor's Project Manager and Job Superintendent.
 - d. Roofing and Flashing Trade Contractor's Project Superintendent.
 - e. Roof manufacturer's technical representative.

- f. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - 1) Section 05 30 00 - METAL DECKING.
 - 2) Section 07 62 00 - SHEET METAL FLASHING AND TRIM.
 - 3) Section 07 71 00 - ROOF SPECIALTIES.
 - 4) Section 07 72 00 - ROOF ACCESSORIES.
 - 5) Section 08 63 00 - METAL-FRAMED SKYLIGHTS.
 - 6) Section 11 40 00 - FOODSERVICE EQUIPMENT.
 - 7) Division 23 - HEATING, VENTILATING AND AIR CONDITIONING.
 - 8) Division 26 – Electrical.
- 3. Agenda:
 - a. Scheduling of roofing operations.
 - b. Review of staging and material storage locations.
 - c. Coordination of work by other trades.
 - d. Installation procedures for mechanical equipment.
 - e. Protection of completed roofing.
 - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
 - g. Emergency rain protection procedure.
 - h. Establish conditions for which a temporary roof will be provided by the Contractor.
 - i. Discuss process for manufacturer's inspection and acceptance of completed roofing and flashings.
 - j. Manufacturer's deck inspection to be performed.

1.5 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification Sections with minimum 5 years documented experience.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 WOOD BLOCKING AND NAILERS FOR ROOFING AND FLASHING

- A. Pressure preservative treated solid wood and plywood blocking required for all work of this Trade Contract 07 00 02 is specified under Section 07 54 19 – POLYVINYL-CHLORIDE (PVC) ROOFING.

2.2 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.3 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

3.1 SITE MAINTENANCE

- A. The Roofing and Flashing Trade Contractor shall furnish and maintain dumpsters as required to adequately control the disposal of all trash, construction debris, and waste materials resulting from the work of this Trade.
 - 1. The Roofing and Flashing Trade Contractor is responsible for all costs to obtain, maintain and disposal of dumpsters.
 - 2. Disposal: Empty dumpsters on frequent regular basis as necessary to prevent overflow spillage. Legally dispose of waste off-site.
- B. Daily clean work areas. Sweep and place into the dumpster(s) furnished by this trade, all removed existing roofing and flashing materials, pallets, construction debris, unused materials, and other waste materials resulting from the Work of this Filed-sub-trade.
- C. After completion of the work of this Section, remove equipment, tools, and unused materials, remove all remaining waste materials and construction debris related to the work of this Filed Sub-trade. Clean all exterior finish materials completely free from adhesives, sealants, and other materials installed under this Section.

End of Section

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Section 07 11 13
BITUMINOUS DAMPPROOFING
(TRADE CONTRACT REQUIRED AS PART OF 07 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Furnish and install fluid applied bituminous dampproofing:
 - 1. Apply over exterior of building foundation walls, below grade.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE.
- D. Section 07 00 01 - WATERPROOFING, DAMPPROOFING AND CAULKING FILED SUB-BID REQUIREMENTS
- E. Section 07 16 13 - POLYMER MODIFIED CEMENT WATERPROOFING: Waterproofing at elevator pit.
- F. Section 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D1227 - Emulsified Asphalt Used as a Protective Coating for Roofing.
 - 2. ASTM D2823 - Asphalt Roof Coatings.
 - 3. ASTM D449 - Asphalt Used in Dampproofing and Waterproofing.
 - 4. ASTM D4586 - Asphalt Roof Cement, Asbestos-Free.

5. NRCA Roofing and Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for dampproofing.
 2. Manufacturer's application instructions including, joint and crack treatment, application temperature range, and any special procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store dampproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Store all materials following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing and from high heat, flames or sparks.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not apply when ambient temperatures may fall below 35 degrees Fahrenheit for 24 hours before and during application and until membrane has cured.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate and schedule the work of this Section with the related work of Section 04 20 00 - UNIT MASONRY, in a manner so as not to delay the smooth progress of the Work.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or equal:
1. Karnak Corporation, Clark NJ.
 2. Tremco Barrier Solutions, Inc., Reynoldsburg OH
 3. W.R. Meadows, Inc., Hampshire IL.

2.3 MATERIALS

- A. Dampproofing at below grade foundation walls: Solvent based, non-asbestos, bituminous compound equal to Karnak Product: "Number 229AR Elastomeric" complying with ASTM C836.

- B. Crack filler: As recommended by the dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify items which penetrate surfaces to receive dampproofing are rigidly installed.
 - 2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
- B. Notify the Contractor if substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 04 20 00 - UNIT MASONRY. Do not proceed until patching is completed.
- C. Do not apply dampproofing to damp, frozen, dirty, dusty or surfaces unacceptable to dampproofing manufacturer.
- D. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Perform all preparation work on receiving surfaces as required, including removal of fins, scaling, and projecting rough spots, and removal of all loose mortar, dirt, oil, and other foreign matter from the substrate.
- B. Protect adjacent surfaces not designated to receive dampproofing.
- C. Cracks and joints in substrate surface must be properly sealed as recommended by the dampproofing manufacturer.

3.3 APPLICATION

- A. Perform the application of the dampproofing in strict accordance with the manufacturer's installation instructions, and as specified herein.
 - 1. Apply joint tape at all sheathing joints . Apply thin coating of dampproofing material over joints and embed joint tape.
- B. After application of joint tape, thoroughly clean all surfaces and apply one coat of dampproofing material by trowel application in strict accordance with written instructions of the manufacturer.
- C. Apply primer when so required by manufacturer's instructions.
- D. Trowel, spray or brush apply as applicable to specified product, in one coat leaving no pinholes, defects or undercoated areas. Apply at coverage rate recommended by the manufacturer but not less than 4 to 6 gallons per 100 square feet.
- E. At exterior sheathing, apply coating after wall anchors have been attached to sheathing, covering anchors with coating.

- F. After application of dampproofing is completed, carefully inspect the entire dampproofed surface for defects therein and patch all defects discovered.

3.4 PROTECTION

- A. Protect dampproofing film and allow to cure for at least 48 hours before installation of rigid insulation.

End of Section

Section 07 13 53
ELASTOMERIC SHEET WATERPROOFING
(TRADE CONTRACT REQUIRED AS PART OF 07 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. The work of this Section consists of waterproofing system(s) where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Foundation Waterproofing System - "Adhered Vertical Waterproofing": Self-adhesive sheet membrane vertical waterproofing applied to exterior surfaces of new below-grade concrete walls.
 - a. Prefabricated composite drainage board over membrane waterproofing system.
- C. Factory representative field inspections of installed waterproofing.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE:
 - 1. Forming and placing concrete foundations, walls and slabs.
 - 2. Waterstops cast-in concrete.
- D. Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS
- E. Section 07 16 13 - POLYMER MODIFIED CEMENT WATERPROOFING: Waterproofing at elevator pits.

- F. Section 07 26 00 - VAPOR RETARDERS: Below Slab vapor barrier.
- G. Division 31 - EARTHWORK: Placement of backfill against sheet membrane waterproofing.
- H. Division 33 - UTILITIES: Foundation wall subdrainage system.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ACI 515 - Guide to the Use of Waterproofing, Dampproofing, and Protective and Decorative Barrier Systems for Concrete.
 - 2. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
 - 3. ASTM C 836 Standard Specification for High Solids, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.
 - 4. ASTM C 898 Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course.
 - 5. ASTM D 146 - Sampling and Testing Felted and Woven Fabrics Saturated with Bituminous Substances for Use in Waterproofing and Roofing.
 - 6. ASTM D 412 - Standard Test Methods for Rubber Properties in Tension.
 - 7. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
 - 8. ASTM D 903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
 - 9. ASTM D 1079 - Standard Terminology Relating to Roofing and Waterproofing.
 - 10. ASTM D 1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.
 - 11. ASTM D 1682 - Test Methods for Breaking Load and Elongation of Textile Fabrics.
 - 12. ASTM D 1876 Standard Test Method for Peel Release of Adhesives (T-Peel).
 - 13. ASTM D-1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
 - 14. ASTM D-3767 - Standard Practice for Rubber - Measurements of Dimensions.
 - 15. ASTM D 3787 - Test Method for Bursting Strength of Knitted Goods: Constant Rate of Traverse (CRT), Ball Burst Test.
 - 16. ASTM D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
 - 17. ASTM D 5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.
 - 18. ASTM E 96 - Tests for Water Vapor Transmission of Materials in Sheet Form.
 - 19. ASTM E 154 - Testing Materials for Use as Vapor Barriers Under Concrete Slabs and as Ground Cover in Crawl Spaces.

- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. International Concrete Repair Institute (ICRI) Technical Guideline No. 03730 - Surface Preparation Guidelines for the Repair of Deteriorated Concrete Resulting From Reinforcing Steel Corrosion.
 2. International Concrete Repair Institute (ICRI) Technical Guideline No. 03732 – Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.
- C. Definitions:
1. “Low Temperature”: The term “Low Temperature” is used herein for purposes of defining selection of appropriate waterproofing products which are manufactured for use in a specific temperate range. “Low Temperature” products are appropriate in ambient and substrate conditions which are below 40° F. (5° C.) and above 25° F. (-4° C.).

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing: Coordinate the work of this Section with the respective trades responsible for installing work concealed by waterproofing.
1. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties.
 2. Shop Drawings:
 - a. Provide large scale details of all termination and transition details, penetrations, and drainage composite.
 - b. Provide large scale details of crack treatment in concrete substrate.
 3. Verification Samples:
 - a. 24 by 24 inch samples of Fluid applied membrane applied to cement board substrate.
 - b. 24 by 24 inch samples Prefabricated drainage composite.
 - c. 24 by 24 inch samples of each type of sheet membrane waterproofing.
 4. Test and Evaluation Reports: Submit manufacturer's test reports of in-place testing performed by an independent testing agency.
 5. Manufacturer's Pre-Warranty Certification: Manufacturer's written certification that shop drawings and proposed systems and components have been

reviewed and accepted by the manufacturer for the specified manufacturer's warranty.

6. Manufacturer's Instructions: Manufacturer's application instructions including data for surface conditioners, joint and crack treatment and application temperature range.
 7. Applicator Reports:
 - a. Review statement: Written statement, signed by the waterproofing applicator, stating that the Contract Drawings have been completely reviewed with an agent of the waterproofing system manufacturer; accompanied by a written statement from the manufacturer that the selected sheet membrane waterproofing system is proper, compatible, and adequate for the application shown.
 - 1) The waterproofing applicator will notify the Architect and Owner in writing that the as-built field conditions when exposed are in conflict with the Contract Documents for the proper application of the selected waterproofing system or the warranty requirements.
 8. Manufacturer Reports: Submit manufacturer's representative's field inspections reports.
 9. Qualification Submittals:
 - a. Workmen Qualifications: Statement of qualifications for on-site supervisor, as required under the Article entitled "Quality Assurance" specified herein below, include certifications of workers who have completed a installation training program.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation: Manufacturer's and Applicator's warranties, include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 1. Field Supervised Work: Contractor shall notify Architect before beginning work of this Section. Obtain Architect's approval of Contractor's procedures before proceeding with the work.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of waterproofing system.
- C. Qualifications:
 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, trained and authorized by product manufacturer.
 - a. Qualifications of on-site supervisor (foreman): Minimum 5 years experience in successful application of specified waterproofing system, fully trained, and authorized by the waterproofing manufacturer.

- b. Qualifications of on-site workman: The Applicator shall maintain a steady work crew consisting of qualified craftsmen and a full time foreman (supervisor), on site daily. The Contractor shall confirm that all workmen under his direction fully understand the requirements of the job.
 - 2. Testing Agencies: Submit to Architect/Engineer a minimum of three independent testing laboratories for flood testing or EVFM testing as specified.
- D. Manufacturer's On-site Inspections: Make arrangements to have Manufacturer's representative (employed by manufacturer) be present on-site during the Work of this Section at key points, which include, but are not limited to:
 - 1. Pre-installation conference.
 - 2. Review of installation procedures (a minimum of 2 site visits are required).
 - 3. Inspection of installation prior to flood testing.
- E. Preconstruction Testing: Applicator's review statement that in-situ conditions are acceptable for application of waterproofing system.

1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 29 – MOCK-UPS.
 - 1. General horizontal waterproofing mockup at deck, minimum 160 square feet of horizontal waterproofing with a not less than a 6 foot length vertical transition. Mockup to represent finished work including internal and external corners, seam jointing, attachment method, and counter-flashing.
- B. Workmen preparing mock-ups shall be same as those performing the work.
- C. Accepted mock-up may remain as part of the work; the number of mock-ups shall not be restricted.
 - 1. Mock-ups not approved shall be removed in their entirety down to substrate.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver and store waterproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. General: Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - a. Store all materials in an elevated, dry location, protected by waterproof coverings.
 - b. Protect materials from freezing.

- c. Store liquid products in a well ventilated area having a minimum ambient temperature of 40 degrees Fahrenheit and a maximum of 80 degrees Fahrenheit. Protect primers, mastic and adhesives from high heat, flames or sparks.
 - 3. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle.
 - C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
- 1.10 SITE CONDITIONS
- A. Maintain ambient temperatures above 40 degrees Fahrenheit for 24 hours before and during application and until liquid or mastic accessories have cured.
- 1.11 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
 - B. Manufacturer's Warranty: Provide 5 year Manufacturer's warranty which shall include replacement of defective materials.
 - C. Special Warranty: Provide 3 year Applicator's warranty or performance bond which shall include removal and replacement of defective materials, and repairs or replacement of Owner's materials and products damaged due to failure of waterproofing installation to resist water or moisture penetration
 - D. Extended Correction Period: Membrane waterproofing shall be guaranteed for 3 years with the Contractor or water-proofing Subcontractor agreeing to repair or replace work which leaks or otherwise fails to perform as required due to failures of materials or workmanship. This shall include the removal and replacement of any work which conceals the membrane work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on GCP Applied Technologies Inc., ("Grace") Cambridge MA.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Carlisle Coatings and Waterproofing, Inc., Wylie, TX., ("Carlisle").
 - 2. GCP Applied Technologies Inc., Cambridge MA., ("Grace").
 - 3. Henry Company, El Segundo CA., ("Henry").
 - 4. Polyguard Products Inc. Ennis, TX., ("Polyguard").

5. W.R. Meadows, Hampshire, IL., ("Meadows").

2.2 FOUNDATION WATERPROOFING SYSTEM - ADHERED VERTICAL WATERPROOFING

- A. Basis of Design (Specified Product): GCP Applied Technologies Inc., Cambridge MA., ("Grace") product: "Bituthene 3000".
 1. Acceptable Manufacturers/Products: Subject to compliance with the requirements specified herein, similar sheet waterproofing products include the following:
 - a. Carlisle, product "MiraDri 860/861".
 - b. Grace, product "Bituthene 3000".
 - c. Henry, product "Blueskin WP 200".
 - d. Polyguard, product "Polyguard Underseal PRM".
 - e. Meadows, product "Mel-Rol".
- B. Sheet membrane: Prefabricated composite sheet, minimum of 60 mils thick, consisting of 56 mils thickness of rubberized asphalt and 4 mils thick cross-laminated polyethylene film, self-adhering after removal of release paper, and furnished in 36 or 48 inch wide rolls, formulated for anticipated ambient temperature, and meeting or exceeding the specified physical properties.
- C. Waterproofing Membrane Physical Properties:
 1. Flexibility: Unaffected when tested by ASTM D 1970 at -25 degrees F.
 2. Tensile strength for membrane, as per ASTM D 412, modified: 300 pounds per square inch, minimum.
 3. Tensile strength for film, as per ASTM D 412, modified: 5,000 pounds per square inch, minimum.
 4. Elongation, as per ASTM D 412, modified: 300 percent, minimum.
 5. Cycling over crack at minus 25 degrees Fahrenheit: No effect at 100 cycles.
 6. Peel adhesion, when tested per ASTM D 903 (modified) for 7 days dry at 70 degrees Fahrenheit and 120 degrees Fahrenheit and for 7 days wet at 70 degrees Fahrenheit: 7.5 pounds per inch width, minimum.
 7. Puncture resistance for membrane, (ASTM E 154): 40 pounds, minimum.
 8. Resistance to hydrostatic head of water when tested per ASTM D 5385: 200 feet of water, minimum.
 9. Exposure to fungi in soil for 16 weeks, as per GSA-PBS 07111: Unaffected.
 10. Permeance as per ASTM E 96, Method B: 0.05 perms (grains/sq. ft./hr./in. Hg), maximum.
 11. Water absorption, as per ASTM D 570: 0.2 percent by weight, maximum.
- D. Primer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.
 1. Carlisle:
 - a. Conventional use: CCW-702.
 - b. Low temperature: CCW-702LT.

- c. Green or damp concrete: CCW-715.
- 2. Grace:
 - a. Conventional use: WP-3000.
 - b. Low temperature: B2.
 - c. Green or damp concrete: B2.
- 3. Henry:
 - a. Conventional use: Aquatac.
 - b. Low temperature: Blue Skin Adhesive.
 - c. Green or damp concrete: No available product.
- 4. Polyguard:
 - a. Conventional use: "Polyguard 650 LT Liquid Adhesive" or "Polyguard California Sealant".
 - b. Low temperature: "Polyguard 650 LT Liquid Adhesive".
 - c. Green or damp concrete: No available product.
- 5. Meadows:
 - a. Conventional use: Mel-Prime.
 - b. Low temperature: Mel-Prime VOC.
 - c. Green or damp concrete: No available product.

2.3 ACCESSORIES

- A. Drainage Composite Board: Prefabricated geocomposite drainage mat consisting of a formed polystyrene or PVC hollow-studded core with one side bonded with a woven or non-woven polypropylene filter fabric, which is compatible to waterproofing manufacturer. Drainage composite shall be designed to promote positive drainage while serving as a protection course.
 - 1. Carlisle, product series "CCW MiraDRAIN" drainage composites.
 - a. Vertical applications: Carlisle "CCW MiraDRAIN 6200", with polymeric backing.
 - 1) Thickness: nominal 0.40 inch thick [10.16 mm].
 - 2) Compressive Strength: 15,000 psi (tested per ASTM D1621).
 - 3) Maximum flow rate: 16 gallons per minute per square foot flow (tested per ASTM D 4716).
 - 2. Grace, product series "Hydroduct" drainage composites:
 - a. Vertical applications, Grace product: 220.
 - 1) Thickness: nominal 7/16 inch thick [11 mm].
 - 2) Compressive Strength: 15,000 psf (tested per ASTM D1621).
 - 3) Maximum flow rate: 17 gallons per minute per square foot flow (tested per ASTM D 4716).
 - 3. Henry, product series "DB" drainage composites.
 - a. Vertical applications, Henry product: "DB 520", with polymeric backing.
 - 1) Thickness: nominal 7/16 inch thick [11 mm].
 - 2) Compressive Strength: 15,000 psi (tested per ASTM D1621).

- 3) Maximum flow rate: 16 gallons per minute per square foot flow (tested per ASTM D 4716).
 4. Polyguard, product series "Polyflow" drainage composites:
 - a. Vertical applications, Polyguard product: Polyflow 15P Drainage Mat". (1/2 inch thick, 16 gallon per minute flow).
 5. Meadows, product series "Mel-Drain" drainage composites.
 - a. Vertical applications, Meadows product: "5035-B", with polymeric backing.
 - 1) Thickness: nominal 7/16 inch thick [11 mm].
 - 2) Compressive Strength: 15,000 psi (tested per ASTM D1621).
 - 3) Maximum flow rate: 16 gallons per minute per square foot flow (tested per ASTM D 4716).
- B. Primers, Sealants, crack filler, mastics, liquid detailing compound, tape, and adhesives: As recommended by the waterproofing manufacturer.
1. Primer, as recommended for substrate conditions by waterproofing manufacturer: Rubber based low VOC content primer formulated with high solids content which shall comply with regulatory VOC requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
1. Verify items which penetrate surfaces to receive waterproofing are rigidly installed.
 2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
 3. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Preinstallation Testing: Verify concrete substrate has been cured and is sufficiently dry in accordance with the waterproofing manufacturer's recommended application requirements.
- C. Evaluation and Assessment:
1. Notify the Contractor in writing if concrete substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 03 30 00 - CAST-IN-PLACE CONCRETE. Do not proceed until patching is completed.
 2. Do not apply waterproofing to damp, frozen, dirty, dusty or surfaces unacceptable to membrane manufacturer.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect finished materials and products against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all materials which are soiled or otherwise damaged by Work of this Section. Materials and finishes

which cannot be cleaned, or repaired shall be removed and replaced with new work to match .

- B. Substrate Preparation – new concrete:
 - 1. Cast-in-place concrete must be smooth, and free of unapproved curing compounds, form release agents and other surface contaminants.
 - 2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 3. Repair bugholes over 1/2 inch in length and 1/4 inch deep and finish flush with surrounding surface.
 - 4. Remove scaling to sound, unaffected concrete and repair exposed area.
 - 5. Grind irregular construction joints to suitable flush surface.
- C. Cracks and joints in substrate surface must be properly sealed with joint filler and sealant as recommended by the sheet membrane waterproofing manufacturer.

3.3 INSTALLATION – GENERAL

- A. Apply waterproofing system in strict accordance the manufacturer's installation specifications, Contract Document details, approved shop drawings and the recommendations of Manufacturer's on-site technical representative, and as additionally specified herein.

3.4 INSTALLATION ADHERED VERTICAL WATERPROOFING

- A. Primer: Where sheet membrane is to be applied, apply primer as recommended by manufacturer at a rate of 250 to 350 square feet per gallon; areas not covered with membrane in 24 hours must be reconditioned.
- B. General: Perform the application of the sheet membrane waterproofing system in strict accordance with the manufacturer's installation specifications, details, and recommendations, and as specified herein.
 - 1. At all external and internal corners, apply a continuous strip of sheet membrane, at least 12 inches wide, centered on the axis of the corner, before the general application of the membrane.
 - 2. Apply 8 inch wide strips of the sheet membrane over all cracks greater than 1/16 inch in width.
 - 3. Apply a double layer of the sheet membrane around all penetrations in the surface. Apply a bead of compatible sealant between the top layer of membrane and the clamping rings of penetrating items and at all terminations.
 - 4. Apply the sheet membrane in strips of 8 feet in length or less, overlapping edge seams at least 2-1/2 inches. Stagger all end laps. Roll the entire surface of the membrane firmly and completely, as soon as possible after application thereof. Seal all tee joints at the end of each working day. Seal all daily terminations, and permanent terminations with manufacturer's recommended sealant material.
- C. After application of membrane is completed, carefully inspect the entire waterproofed surface for defects therein. Patch tears and inadequately lapped seams with membrane material. Slit fishmouths, repair with a patch extending at least 6 inches in all directions from the slit, and seal all edges of the patch with manufacturer's recommended sealant.

- D. Arrange for inspection of waterproofing system by representative of waterproofing manufacturer, prior to installation of insulation and backfill. Schedule and sequence manufacturer's inspection in manner to prevent delays in construction schedule.

3.5 INSTALLATION OF ACCESSORIES

- A. Application - Drainage Composite Board (Vertical Application).
 1. Apply drainage composite board in a manner acceptable by the membrane manufacturer and as recommended by the composite board manufacturer and following the general guidelines specified herein.
 2. Install composite drainage board on same day sheet membrane waterproofing is applied.
 3. Apply first row of drainage composite board horizontally starting at base of foundation, peel fabric back approximately 12 inches from the lower edges, tuck exposed drain core behind perimeter subdrainage pipe installed under Section 33 46 00 - SUBDRAINAGE and wrap fabric over pipe.
 4. Adhere drainage composite to membrane as recommended by membrane manufacturer.
 5. Apply subsequent rolls of drainage composite butted tightly to previous row, overlapping fabric over next lowest row.
 6. At inside corners, cut backing but not fabric. At outside corners cut backing and fabric and overlay with second layer of fabric, adhered.
 7. Terminate composite board system at 6 inches below finish grade.
 8. Patch or replace any damage to fabric prior to backfilling.

3.6 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the general provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Manufacturer Services: Submit to Architect manufacturer's final acceptance report following inspection of installed waterproofing within 14 calendar days following inspection.

3.7 CLEANING

- A. Clean all finished surfaces which have been damaged by the work of this Section.

3.8 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Protect applied sheet membrane waterproofing and composite drainage board fabric from damage by other trades, construction materials or backfill.

End of Section

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Section 07 16 13

POLYMER MODIFIED CEMENT WATERPROOFING
(TRADE CONTRACT REQUIRED AS PART OF 07 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

Prepare surfaces and repair cracks in substrate scheduled to receive waterproofing.

- A. Furnish and install cementitious waterproofing at walls and floor of elevator pits.
- B. Recesses in concrete for entrance grids.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete foundation walls.
- D. Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS
- E. Section 07 11 13 - BITUMINOUS DAMPPROOFING.
- F. Section 07 92 00 - JOINT SEALANTS: Sealant materials, for control joints in concrete.
- G. Section 14 24 00 - HYDRAULIC ELEVATORS: Plunger casing, piston and related water stops.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM B 117 - Salt spray resistance.

2. ASTM C 67 - Methods of Sampling, and Testing Brick and Structural Clay Tile.
3. ASTM C 109 - Compressive Strength.
4. ASTM C 190 - Tensile Strength.
5. ASTM C 348 - Flexural Strength.
6. ASTM C 469 - Modulus of Elasticity.
7. ASTM C 531 - Coefficient of Thermal Expansion.
8. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
9. ASTM E 96 - Water Vapor Transmission of Materials.
10. ASTM G 26 - Accelerated Weathering.
11. FS TT-P-29B - Fungus Growth Resistance.
12. FS TT-P-141b - Abrasion Strength.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data and physical properties.
 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

- A. Waterproofing applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
- B. Make all necessary arrangements with the respective waterproofing systems manufacturer to provide qualified supervision at the site, commencing immediately prior to the first application of materials, and continuing until completion of the application all waterproofing materials. Perform all preparation, mixing, and application procedures as recommended by each manufacturer's representative. Bear all costs in conjunction with such supervision.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store waterproofing materials in new, sealed, containers showing manufacturer's identification, year of production, net weight, date of packaging, and location of packaging.
- B. Store all materials in an elevated, dry location, protected by waterproof coverings. Following manufacturer's recommended storage procedures for humidity and temperature conditions, protect materials from freezing.

1.8 PROJECT CONDITIONS

- A. Maintain ambient temperatures above 40 degrees Fahrenheit for 24 hours before and during application and 72 hours after until cementitious waterproofing has cured.
- B. Water saturated substrates scheduled to receive waterproofing must be fully dried and areas of active water leakage must be repaired prior to application of waterproofing.
- C. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.2 CEMENTITIOUS WATERPROOFING

- A. Manufacturer: Products which may be considered by the Architect, include the following:
 - 1. Five Star Products, Inc., Fairfield CT., product "Five Star Cementitious Waterproofing".
 - 2. Silpro Masonry Systems, Inc., MA., product "Sealcoat", with C21 "All Acrylic" admix.
 - 3. BASF Corporation, Shakopee, MN. "Masterseal 581" (*formerly "Thoroseal"*).
- B. Cementitious waterproofing system meet the following minimum requirements:

Properties	Test	Results
Bond Strength:	ASTM C 882	2,000 psi
Tensile Strength:	ASTM C 190	7 day: 250 psi (2 MPa) 28 day, 440 psi (3 MPa)
Flexural Strength	ASTM C 348	7 day: 360 psi (2.5 MPa) 28 day, 1027 psi (72.4 kg/cm ²)
Modulus of Elasticity	ASTM C 469	2.72 x 10 ⁶ psi 1.87 x 10 ⁴ MPa
Adhesion strength	Tensile bond	418 psi. (2.9 MPa)
Compressive Strength	ASTM C 109	1 day: 4000 psi (280.8 kg/cm ²) 7 days, 6300 psi (442.4 kg/cm ²)
Coefficient of Thermal Expansion	ASTM C 531	6.99 x 10 ⁻⁶ in/in°F
Accelerated Weathering	ASTM G 26	5000 hours, pass with no change
Fungus Growth Resistance	FS TT-P-29B	meets all requirements
Abrasion Strength	FS TT-P-141b	passed

Permeability	ASTM E 96	12 perms
Water Absorption	ASTM C 67	3.6 percent (24 hours boiling test)
Salt spray resistance	ASTM B 117	no deterioration or loss of adhesion

- C. Joint filler, and other installation accessories: As recommended by the waterproofing manufacturer.
- D. Portland cement plaster to be mixed with waterproofing: As recommended by the waterproofing manufacturer.
- E. Water: Clean and fresh without contaminates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Verify substrate surfaces are durable; free of frozen matter, dampness, loose particles, cracks, pits, projections, or foreign matter detrimental to adhesion or application of waterproofing system.
 - 2. Verify that substrate surfaces are smooth, free of pitting, and not detrimental to full contact bond of waterproofing materials.
 - 3. Verify that items which penetrate surfaces to receive waterproofing are securely installed.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive waterproofing.
- B. Thoroughly remove all previously applied coatings. Clean walls by high pressure - wash or sand blast, and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- C. New concrete surfaces to receive waterproofing must cure a minimum of 14 days prior to application of waterproofing materials.
- D. Do not apply waterproofing to surfaces unacceptable to applicator or manufacturer. Perform a bond test as recommended by manufacturer if applicator has any doubt about the suitability of substrate.
- E. Cut out and place a cove of hydraulic cement at wall and floor junction.
- F. Repair cracks, breaks, voids, honeycombing larger than 1/32 inch width with hydraulic cement.
- G. Seal dynamic joints with backer rod and sealant materials using depth to width ratio as recommended by sealant manufacturer.

3.3 APPLICATION

- A. Dampen substrate to prevent surface drag of application.
- B. Apply waterproofing material in accordance with manufacturer's instructions by brush or broom to substrate surfaces. Ensure first coat is well brushed into substrate.
 - 1. Apply a minimum of two thick coats to a total thickness of 1/16 inch.
 - 2. Allow first coat to set a minimum of 4 hours prior to application of second coat. Moisten first coat with fine spray of water before applying second coat.
- C. Ensure there are no pinholes, voids or uncovered areas.
- D. Apply extra thickness of waterproofing material at corners, intersections, and angles.
- E. Seal watertight, items projecting through waterproofing.

3.4 PROTECTION

- A. During the operation of waterproofing work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair and/or replace any work so damaged and soiled.

3.5 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all interfacing wall areas, free from excess deposits of waterproofing, and other materials installed under this Section.

End of Section

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Section 07 21 00
THERMAL INSULATION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Polyisocyanurate insulation at exterior masonry walls.
 - 2. Mineral fiber insulation at top of masonry partitions.
 - 3. Accessories related to the installation of insulation.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS
- D. Section 07 54 19 - POLYVINYL CHLORIDE (PVC) ROOFING: Removal and replacement of existing roof insulation.
- E. Section 09 81 00 - ACOUSTICAL INSULATION: Acoustical batt insulation between framing members.
- F. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ASTM C 203 - Breaking Load and Flexural Properties of Block Type Thermal Insulation.
2. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
3. ASTM C 553 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
4. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
5. ASTM C-612 - Mineral Fiber Block and Board Thermal Insulation.
6. ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
7. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
8. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
9. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
10. ASTM E 84 - Surface Burning Characteristics of Building Materials.
11. ASTM E 96 - Water Vapor Transmission of Materials.
12. All applicable federal, state and municipal codes, laws and regulations for thermal insulation.

B. Definitions:

1. The term "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

- a. Rigid board insulation materials are combustibles and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer's recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in packages containing water marks, or show evidence of mold.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Rigid insulation board (extruded polystyrene):
 - a. Dow Chemical Corp., Midland MI.
 - b. Owens Corning Commercial Insulation, Toledo OH.
 - c. Kingspan Insulation LLC; Atlanta, GA.
 - d. DiversiFoam Products, Rockford, MN
 2. Rigid insulation board (polyisocyanurate):
 - a. Atlas Roofing Corporation, Atlanta, GA.
 - b. The Dow Chemical Co., Midland, MI.
 - c. Hunter Panels, Portland ME.
 - d. Johns Manville Roofing System, Denver, CO.
 - e. Carlisle Syntec, Carlisle PA.
 - f. Firestone Building Products Co., LLC, Indianapolis, IN.
 3. Mineral fiber insulation:
 - a. Johns Manville, Inc., Denver CO.
 - b. Roxul, Inc., Milton, Ontario. (Roxul).
 - c. Thermafiber Inc., Wabash IN. (Thermafiber)

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 MATERIALS

- A. Cavity wall insulation: Foil-faced rigid insulation: Nonstructural, rigid board insulation consisting of a polyisocyanurate foam core laminated between 1.0 mil smooth, reflective aluminum facers on both sides, with square and shiplap edge, conforming to ASTM C 1289, Type I, Class 1, having the following characteristics:

1. Physical properties:
 - a. R-Values per board thickness and edge treatment:
 - 1) Board thickness of 2.0: 13 R-Value, with square and shiplap edge.
 - 2) Board thickness of 3.0: 19 R-Value, with square and shiplap edge.
 - b. Compressive Strength per ASTM D1621: 25 psi min.
 - c. Flexural Strength per ASTM C203: 40 psi min.
 - d. Water Absorption per ASTM C209, (% by volume, max.): 0.1.
 - e. Water Vapor Permeance, ASTM E96, (perm, max.): <0.03.
 - f. Maximum Use Temperature: 250 °F.
 2. Sizes: 4 by 8 feet, 4 by 9 feet and 4 by 10 feet.
 3. Thickness: As indicated on Drawings.
 4. Acceptable products include but are not limited to:
 - a. Dow Chemical Corp., "Thermax Xarmor ci Exterior Insulation".
 - b. Johns Manville, Inc, product "AP Foil-Faced Polyiso Foam Sheathing".
 - c. Rmax Operating, LLC, Dallas, TX, product "ECOMAXci".
- B. Mineral wool fiber / ceramic wool non-combustible insulation at top of masonry walls: Conforming to ASTM C665, Type 1, ASTM C612, and ASTM C553 with a minimum density of 4 pounds per cubic foot.
1. Flame Spread Classification: Material shall be classified non-combustible per ASTM E-814.
 2. Recycled content of slag:: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
 3. Acceptable products include:
 - a. Johns Manville, Inc., Denver CO. product: "MinWool Safing".
 - b. Rock Wool Manufacturing Company, Leeds, AL, product: "Delta Safing Mineral Wool".
 - c. Roxul, Inc., product "Roxul Safe".
 - d. Thermafiber, Inc. product "Safing 4.0 pcf".
 4. Accessories: Provide galvanized steel safing clips as required for installation of insulation.

2.4 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.
- B. Adhesive attached spindle anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
 1. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch, minimum 2 inches square.
 2. Pin: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

3. Adhesive, as recommended by anchor manufacturer for substrate.
4. Acceptable products include the following, or approved equal to:
 - a. Gripnail Corporation, East Providence, RI, product "SnapStik Spindle Anchors".
 - b. Gemco, Danville, IL, product "Perforated Base Insulation Hangers."
 - c. AGM Industries, Brockton, MA. product: Tactoo Insul-Hangers."
- C. Setting adhesive for rigid insulation: Conforming with ASTM C-557.
- D. Wire Insulation Supports: 13 gauge spring type wire with sharp ends designed to hold batt insulation in place between joists/rafters. Provide wire lengths based on joist/rafter spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 INSTALLATION

- A. Rigid insulation in exterior walls:
 1. Apply adhesive to substrate, in three continuous beads per board length to a full bed of 1/8 inch thick.
 2. Place boards in a method to maximize contact bedding. Stagger vertical joints. Butt edges and ends tight to adjacent board and to protrusions. Place impale fastener locking discs. Tape seal board joints.
 3. Install boards horizontally between wall reinforcement.
- B. Mineral Fiber insulation in exterior walls:
 1. Install boards, friction fit, horizontally between wall reinforcement/framing.
 2. Install full thickness of insulation over the entire surface to be installed as indicated. Ensure tight fit around penetrating elements and abutting construction. All voids and gaps shall be filled. Minimize potential for thermal bridging.
 3. Install insulation hold-down clips as per the manufacturer's recommendations, and in conformance with the Building Code.
 4. At completion of each days' work, protect all exposed edges. Seal edges or lap over with a moisture retardant barrier.

3.3 CLEANING

- A. Clean work under provisions of Section 01 73 00 – EXECUTION.
- B. Daily clean work areas by sweeping and disposing of debris, and scraps.

- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 21 13
BOARD INSULATION

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of building foundation insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Rigid insulation at perimeter foundation walls.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 07 26 00 - VAPOR RETARDERS:
 - 1. Vapor barriers and in walls, floor assemblies and roof assemblies.
 - 2. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM C 203 - Breaking Load and Flexural Properties of Block Type Thermal Insulation.
 - 2. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 3. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
 - 4. ASTM D 1621 - Compressive Properties of Rigid Cellular Plastics.
 - 5. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.
 - 6. ASTM E 84 - Surface Burning Characteristics of Building Materials.

7. ASTM E 96 - Water Vapor Transmission of Materials.
8. All applicable federal, state and municipal codes, laws and regulations for thermal insulation.

B. Definitions:

1. The term "R-Value" referred to herein refers to the thermal resistance of the insulation alone and does not allow consideration of air spaces or other factors.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.6 QUALITY ASSURANCE

A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.7 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - a. Rigid board insulation materials are combustible and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer's recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in packages containing water marks, or show evidence of mold.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Dow Chemical Corp., Midland MI.
 2. Owens Corning Commercial Insulation, Toledo OH.
 3. Kingspan Insulation LLC; Atlanta, GA.
 4. DiversiFoam Products, Rockford, MN

2.2 MATERIALS

- A. Under-slab and foundation insulation, rigid extruded polystyrene insulation: Closed cell foam board, square edge, conforming to ASTM C 578, Type IV, with a compressive strength of 25 pounds per square inch when tested in accordance with ASTM D 1621.
1. Panel size: 48 by 96 inches beneath slab, and 24 by 96 inches at verticals.
 2. Minimum R-value: 5 per inch thickness.
 3. Thickness: 2 inches.
 4. Acceptable products include but are not limited to:
 - a. Dow Chemical Corp., product, Styrofoam Brand "Square Edge"
 - b. Owens Corning, product "Foamular 250".
 - c. Kingspan Insulation LLC, product "GreenGuard Type IV 25 PSI Insulation Board".
 - d. DiversiFoam Products, product "CertiFoam 25 SE".

2.3 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.
- B. Adhesive attached spindle anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
1. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch, minimum 2 inches square.
 2. Pin: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.
 3. Adhesive, as recommended by anchor manufacturer for substrate.
 4. Acceptable products include the following, or approved equal to:
 - a. Gripnail Corporation, East Providence, RI, product "SnapStik Spindle Anchors".
 - b. Gemco, Danville, IL, product "Perforated Base Insulation Hangers."
 - c. AGM Industries, Brockton, MA. product: Tactoo Insul-Hangers."

- C. Setting adhesive for rigid insulation: Conforming with ASTM C-557.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 INSTALLATION

- A. Insulation at exterior of foundation walls: 2 inch thick rigid insulation.
 - 1. Place insulation boards at the exterior perimeter of foundation walls and beneath slabs-on grade.
 - a. At exterior perimeter of foundation walls, extend insulation from 2 inches below grade to top of footing.
 - 2. Butt edges and ends tight to adjacent boards. Bevel insulation to allow snug fit at cants.
 - 3. Place soil as a perimeter restraint to minimize movement of insulation.

3.3 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, and scraps.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 24 23
DIRECT APPLIED FINISH SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install:
 - 1. Direct applied finish coating and insulation system; including coatings, embedded reinforcing mesh, and integrally colored finish top coat. The complete system is referred to in the Drawings as "DAFS".
 - a. All related components, including: mastic, control joints, corner beads, casings, fasteners and other accessories.
 - b. Joint sealer and backer materials for junctions with dissimilar materials.

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY.
- D. Section 05 12 00 - STRUCTURAL STEEL FRAMING
- E. Section 05 30 00 – METAL DECKING
- F. Section 06 10 00 - ROUGH CARPENTRY: wood blocking, curbing and nailers.
- G. Section 07 21 00 - THERMAL INSULATION: Interior building insulation, below roof deck.
- H. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Metal flashing, trim, scuppers, gutters, and downspouts.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 014200 - REFERENCES.
 - 1. ASTM C 578 - Preformed Cellular Polystyrene Thermal Insulation.
 - 2. ASTM C 1063 - Installation of lathing and furring for Portland cement based plaster.
 - 3. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
 - 4. ASTM D 2842 - Water Absorption of Rigid Cellular Plastics.

1.4 SUBMITTALS

- A. Information and Review: Submit the following under provisions of Section 013000 - SUBMITTALS:
1. Literature: Manufacturer's product data sheets, specifications, performance criteria, limitations, physical properties on complete system.
 2. Manufacturer's installation instructions: Indicate preparation required, installation techniques, environmental restrictions, and jointing requirements.
 3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 4. Review statement: Written statement, signed by the applicator, stating that the Contract Drawings have been reviewed by an agent of the exterior insulation and finish system manufacturer; accompanied by a written statement from the manufacturer that the selected finish system is proper, compatible, and adequate for the application shown.
 - a. The applicator will notify the Architect and Owner in writing that the existing conditions are in conflict with the Contract Documents for the proper application of the selected finish system.
 5. Shop drawings:
 - a. 1/4 inch scale elevations, indicating wall and soffit joint pattern and joint details.
 - b. Large scale design details of control joints, edges and terminations showing complete installation details.
 - c. All details bearing dimensions of actual measurements taken at the project.
 6. Selection samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - b. Provide finish samples as requested, to assist in the Architect's initial selection of colors and textures.
 7. Verification samples:
 - a. 12 inch long samples of control joints, casings and trim elements.
 - b. 12 by 12 inch samples of reinforcing material.
 - c. 12 by 12 inch fabricated panels, in selected color, illustrating material and finish texture.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's field quality control reports of manufacturer's field inspections.
 2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.5 QUALITY ASSURANCE

- A. System applicator, with a minimum of three years documented experience demonstrating previously successful work of the type specified herein, trained and licensed by product manufacturer.

- B. Source Limitations: To the greatest extent possible for each unit of work, and subject to the restrictions of the Buy American Act, provide products, materials or equipment of a singular generic kind from a single source.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - 1. Protect adhesives and finish materials from freezing.
 - 2. Rigid insulation materials are combustible and may constitute a fire hazard, do not expose insulation materials to open flames or other ignition sources, comply fully with manufacturer's recommendations and the requirements of local authorities having jurisdiction, for delivery, handling, storage and installation.

1.7 PROJECT CONDITIONS

- A. Install all materials in strict accordance with all safety and weather conditions required by the system manufacturer.
- B. Maintain minimum ambient temperature of 50 degrees Fahrenheit degrees during, and 24 hours after, the work of this Section.
- C. Do not apply materials to a substrate surfaces whose temperature is below 40 degrees Fahrenheit.

1.8 WARRANTY

- A. Provide manufacturer's standard 5 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include coverage of materials and workmanship of installation.

1.9 EXTRA MATERIALS

- A. Provide to the Owner, finish repair/patch kit for future touch-up by the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Sto Corporation, "StoQuik Silver" Direct Applied Finish System for Soffits".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Direct Applied Finish System:
 - a. Sto Corporation, Atlanta, GA.

- b. Parex USA, Inc., Anaheim CA.
- c. Dryvit Systems, Inc., West Warwick, RI.
2. Sheathing:
 - a. United States Gypsum Company, Chicago IL. (USG).
 - b. Georgia Pacific Corporation, Gypsum Division, Atlanta GA,.
 - c. National Gypsum Company, Gold Bond Products Division, Charlotte NC. (Gold Bond).
 - d. Lafarge North America, Inc., Reston VA.
3. Sheathing:
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Fin Pan, Inc., Hamilton OH.
 - c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
4. Metal Framing:
 - a. Dietrich Industries, Inc., Pittsburgh PA.
 - b. Georgia Pacific Corporation, Gypsum Division, Atlanta GA.
 - c. Marino Industries Corp., South Plainfield NJ.
 - d. National Gypsum Company, Gold Bond Products Division, Charlotte NC.
 - e. Unimast Incorporated, Franklin Park IL.

2.2 PERFORMANCE CRITERIA

- A. Design Criteria:
 1. Design for maximum allowable system deflection, normal to the plane of the soffit, of $L/360$.
 2. Design for wind load in conformance with code requirements.
 3. Prevent the accumulation of water behind the finish system, either by condensation in the soffit or leakage through other components of construction, by proper design and detailing of the soffit and related construction.
 4. Design minimum 1/2 inch (13 mm) wide expansion joints in the system where they exist in the substrate or supporting construction, at a minimum of every 30 feet (up to a maximum area of 900 sq. ft.), and where the system adjoins dissimilar construction or materials.
 5. Design minimum 1/4 inch (6 mm) wide perimeter sealant joints at penetrations through the system (lights, vents).
- B. System Performance Criteria
 1. Impact Resistance (tested per ASTM E 2486): 90 to 150 in-lbs
 2. Adhesion (tested per ASTM C-297): Minimum 10 psi.
 3. Adhesion after 10 Freeze/Thaw Cycles (tested per ASTM C-297): Minimum 10 psi

2.3 SYSTEM COMPONENTS

- A. Corner bead, casing bead, starter track and expansion joint accessories. All accessories shall meet the requirements of ASTM C1063 and its reference documents. Accessories shall be vinyl (ASTMD1784), zinc (ASTM B69) or galvanized metal (ASTM A525 and A5236), as selected by Architect.
- B. Sheathing Board 1/2 inch thick gypsum sheathing board complying with ASTM C 1177 with fiberglass mat surface front and back with silicone-treated gypsum core conforming with the following requirements:
 - 1. Acceptable Products include the following, or approved equal and acceptable to Direct Applied Finish System Manufacturer:
 - a. USG product "Securock Glass-Mat".
 - b. Georgia Pacific, product: "DensGlass Gold".
 - c. Gold Bond, product: "e²XP Sheathing".
 - d. Lafarge product: "Weather Defense Platinum".
- C. Fasteners:
 - 1. For use with metal framing: Non corroding Type S-212 1-5/8 inch wafer head self-drilling screw fasteners.
 - 2. For use with wood framing: 1-5/8 inch, 20 gage Course thread, non-corroding flat head Hi-Lo type 3 for wood studs.
- D. Base coat: single component factory proportioned one-component, polymer-modified, cement based high build base coat with less than 33 percent Portland cement content by weight, equal to Sto BTS Plus.
- E. Reinforcing Meshes:
 - 1. Standard Mesh: nominal 4.5 oz./yd² (153 g/m²), symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating for compatibility with Manufacturer's base, primer and finish coatings.
 - 2. Detailing Mesh: nominal 4.2 oz./yd² (143 g/m²), flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating for compatibility with Manufacturer's base, primer and finish coatings
- F. Primer (for sand finish): Ready mixed elastomeric acrylic dispersion based primer with fine aggregate, for use prior to application of elastomeric finishes.
- G. Finish: Ready mixed elastomeric acrylic dispersion based textured coating with graded marble aggregate: Flexfinish 1.5 having aggregate gradation 1.2 to 1.8 mm.

2.4 INTERIOR CEILING/SOFFIT FRAMING MATERIALS

- A. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.
- B. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.

- C. Carrying channels, 2 inches deep, 16 gage cold-rolled channels, galvanized.
- D. Support channels: 3/4 inches deep, 16 gage cold-rolled channels, galvanized.
- E. Furring Channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gauge hot-dip galvanized steel conforming to ASTM C 645.
- F. Metal Studs used in ceiling framing: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 20 gage, of widths indicated on the Drawings, or other gages as required under the specified standards to meet fire resistance ratings.

2.5 SEALANT AND BACKING MATERIALS:

- A. For perimeter joints between system and abutting materials and joints within the EFS system: Low modulus type, Multi-component non-sagging gun-grade polyurethane sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type M, Class 25, Grade NS, use NT, M, A and O with a minimum movement capability of ± 50 percent, equal to the following:
 - 1. Tremco, Beachwood OH.; product "Dymeric 240 / Dymeric 240FC".
 - 2. Sonneborn Building Products Inc., Minneapolis MN.; product, "Sonolastic NP2".
 - 3. Pecora Corporation, Harleysville PA.; product "Dynatrol II".
 - 4. Sika Corp, Lyndhurst NJ.; product, "Sikaflex 2CNS".
- B. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod complying with ASTM C 1330, Type C, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal.
 - 1. Nomaco, Inc., Zebulon, NC, product "Green Rod".
 - 2. Industrial Thermo Polymers Ltd., Brampton, Ontario CN, product "ITP Standard Backer Rod".
 - 3. BASF Construction Chemicals (Sonneborn), Shakopee MN, product "Sonolastic Closed Cell Backer Rod".
 - 4. W.R. Meadows Inc., Hampshire, IL, product "Sealtight Kool-Rod".
- C. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
- D. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

2.6 ACCESSORIES

- A. Exterior soffit vents: Equal to Fry Reglet Corporation, extruded aluminum soffit, model DRM-50-V-300 having a 3 inch reveal width.

1. Finish: factory spray-applied, baked-on primed paint, ready to receive field applied paint finish.

2.7 MIXING

- A. Mix components as directed by manufacturer's written instructions to a uniform consistency with clean, rust-free electric drill and paddle. Mix only as much material as can readily be used before setting.
 1. Prohibit or limit addition of water as recommended by manufacturer to achieve desired finish texture. Do not use anti-freeze compounds or other additives

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that substrate and adjacent materials are dry. Verify that 'substrate is flat, free of irregularities. And the following:
 1. Contamination such as: algae, chalkiness, dirt, dust, efflorescence, form oil, fungus, grease, laitance, mildew or other foreign substances.
 2. Cracks: measure crack width and record location of cracks, review with Architect before proceeding with the work.
 3. Sheathing damage and deterioration.
 4. Moisture content and moisture damage: use a moisture meter to determine if the surface is dry enough as recommended by finish system manufacturer to receive the coatings and record any areas of moisture damage.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION OF CEILING/SOFFIT FRAMING

- A. Install framing to height indicated, independent of walls, columns, and above ceiling work. Erect after Work above ceiling is complete. Coordinate the location of hangers with other work.
- B. Securely anchor hangers to structural members or embed in structural slab. Space hangers to achieve deflection limits indicated.
- C. Space main carrying channels at maximum 48 inch centers; not more than 4 inches from wall surfaces. Lap splice securely.
- D. Securely fix furring channels or metal studs to hangers to prevent turning or twisting and to transmitted full load to hangers.
 1. Place furring channels perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls and rigidly secure. Lap splice securely.
 2. Screw fasten metal studs perpendicular to carrying channels at 16 inches on center, not more 1 inch from perimeter walls. Lap splice securely.

- E. Reinforce openings in suspension system which interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches past each opening.
- F. Tolerances: Install ceiling framing with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

3.3 SHEATHING INSTALLATION

- A. Verify compliance that framing shall have a planar tolerance 1/4 inch in 10-0 feet [6mm in 3048 mm] deviation in plane).
- B. Install sheathing in strict compliance with manufacturer's recommended installation instructions and as specified here, comply with all applicable code requirements.
 - 1. Install specified control joints where indicated on Drawings.
- C. Secure sheathing with long dimension perpendicular to framing with ends over firm bearing, stagger joints where possible. Use maximum lengths possible to minimize number of joints.
 - 1. Install sheathing with panel edge joints no greater than 1/8 inch (maximum) spacing to abutting sheathing panels and at all sheathing termination edge and end joints.
 - 2. For metal framing: Install screws with 8 inch on center spacing 1/2 inch in from edge around perimeter of each sheathing board, and 8 inches on center in field.
 - 3. Drive fasteners tight and flush with surface of sheathing, do not countersink.
 - 4. Locate fasteners minimum 1/2 inch from edges and ends of sheathing panels
 - 5. Drive fasteners tight and flush with surface of sheathing, do not countersink.

3.4 SHEATHING INSTALLATION

- A. Install sheathing in strict compliance with manufacturer's recommended installation instructions and as specified here, comply with all applicable code requirements.
 - 1. Install specified control joints where indicated on Drawings.
 - 2. Fasten cement board with specified screws every 8 inches on center, in field, and along edges.
 - a. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.

3.5 APPLICATION OF COATING

- A. General: Apply finish system and all trim components in strict accordance with manufacturer's instructions.
- B. Install perimeter trim and control joints.
 - 1. Install appropriate starter accessory and casing bead accessories at system terminations (such as expansion or control joints, lights or vent strips) in accordance with locations indicated on architectural drawings. Maintain a gap of minimum 1/4" (6 mm) between the accessory and the abutment to form a sealant joint.

2. Follow accessory manufacturer's instructions for accessory butt joints to maintain water tightness.
 3. Provide control joints in sheathing at minimum intervals of 30 feet (9.1 m) up to a maximum area of 900 square feet (82.8 m²), wherever the system abuts dissimilar construction or an existing joint occurs in construction. Fit sheathing snugly into accessories prior to attachment.
 4. Fasten surface mount accessories (for example, casing beads and surface mount expansion joints) through the sheathing into framing at locations indicated on architectural drawings. Where necessary, level surfaces such as outside corners with appropriate leveling material to maintain plumbness and squareness.
- C. Application of Base Coat:
1. Apply base coat over the sheathing with proper spray equipment or a stainless steel trowel to a uniform thickness of approximately 1/16 inch (1.6 mm). Apply base coat in strips of 40 inches (1 m) and immediately embed reinforcing mesh into the wet base coat by troweling from the center to the edge of the mesh. Avoid wrinkles in the mesh. Overlap the mesh minimum 2 1/2 inches (64 mm) at mesh joints and stagger mesh overlaps minimum 8 inches (200 mm) from sheathing joints.
 2. Where surface mount accessories are used, such as deep "V" expansion joint, overlap the mesh from the sheathing onto the perforated accessory flange (refer to details).
 3. The mesh must be fully embedded so that no mesh color shows through the base coat when it is dry. Feather mesh overlaps to avoid reading the mesh through the finish coating. Allow base coat to thoroughly dry before applying primer or finish.
 4. For soffit applications that will utilize a heavy texture finish coat to conceal minor surface irregularities, the full mesh may be deleted. Tape joints with a 6 inch (150 mm) wide strip of mesh embedded in base coat, then apply minimum 1/16 inch (1.6 mm) thick base coat over the entire surface of the sheathing. Feather the taped sheathing joints to avoid reading the joints through the finish coating.
- D. Primer (for sanded finish): apply with brush, roller or proper spray equipment over the clean, dry base coat and allow to dry thoroughly before applying finish.
- E. Application of Finish Coat:
1. Apply finish directly over the base coat (or primed base coat) only after the base coat/primer has thoroughly dried.
 2. Apply the finish by spraying, or troweling with a stainless steel trowel in accordance with manufacturer's recommendations to achieve desired finish. General rules for application of finishes are as follows:
 - a. Avoid application in direct sunlight.
 - b. Apply finish in a continuous application, always working to a wet edge.
 - c. Weather conditions affect application and drying time. Hot or dry conditions limit working time and accelerate drying and may require adjustments in the scheduling of work to achieve desired results; cool or damp conditions extend working time and retard drying and may require

added measures of protection against wind, dust, dirt, rain and freezing.
Adjust work schedule and provide protection.

- d. Do not install finish on accessories.
 - e. Do not install separate batches of finish side by side.
 - f. Do not apply finish over irregular or unprepared surfaces, or surfaces not in compliance with the project specifications.
- F. Apply sealant at finish perimeter and control joints in accordance with the requirements of Section 07 92 00 - JOINT SEALANTS.

3.6 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of coatings and adhesives, and other materials installed under this Section.

3.7 PROTECTION

- A. Do not permit finish surface to become soiled or damaged.

Section 07 26 00
VAPOR RETARDERS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of vapor retarders (vapor barriers) where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Sheet membrane vapor barriers (vapor retarders) under concrete slabs-on-grade including seam tape, and pipe boots.

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Reinforced concrete slabs on grade over vapor barrier.
- B. Division 31 – EARTHWORK: Bid Package 1 Soil preparation.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 570 - Water Absorption of Plastics.
 - 2. ASTM D 1004 - Initial Tear Resistance of Plastic Film and Sheeting.
 - 3. ASTM D 1622 - Apparent Density of Rigid Cellular Plastics.
 - 4. ASTM D 1938 - Tear Propagation Resistance of Plastic Film and Thin Sheeting by a Single-Tear Method.
 - 5. ASTM D 2842 - Water Absorption of Rigid Cellular Plastics.
 - 6. ASTM D 2582 - Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
 - 7. ASTM D 2856 - Open Cell Content of rigid Cellular Plastics by Air Pycnometer.
 - 8. ASTM E 136 - Behavior of Materials in a Vertical Tube Furnace at 750°C.

9. ASTM E 154 - Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover
10. ASTM E 1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
11. ASTM E 1745 - Plastic Vapor Retarders Used in Contact with Soil or Granular fill under Concrete Slabs
12. ASTM E 84 - Surface Burning Characteristics of Building Materials.
13. ASTM E 96 - Water Vapor Transmission of Materials.

- B. General References The following reference materials are hereby made a part of this Section by reference thereto:
1. ACI 302.1R Vapor Barrier Component (plastic membrane) is not less than 10 mils thick.
 2. NFPA 701 - Fire Tests for Flame Resistant Textiles and Films
 3. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing: Coordinate work of this section with related work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Manufacturer's Instructions: Manufacturer's installation instructions for placement, seaming and pipe boot installation.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section for each type of vapor retarder shall be from a single manufacturer, and the related accessories as recommended by the prime manufacturer of the vapor retarder.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.2 UNDER SLAB VAPOR BARRIERS

- A. Manufacturers and products:
1. Specified Product (Basis of Design): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Stego Industries LLC company, Product: "Stego Wrap (15 mil)".
 2. Acceptable manufacturers: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include, but are not limited to, the following:
 - a. Stego Industries LLC, San Juan Capistrano, CA, product: "Stego Wrap (15 mil)".
 - b. W.R. Meadows, Hampshire, IL, product: "No. 723 Perminator (15 mil)".
 - c. Reef Industries, Houston, TX, product "Griffolyn -15 Mil Green".
 - d. Insulation Solutions Inc., East Peoria IL, product "Viper II, 15 mil vapor barrier".
- B. Characteristics:
1. Minimum thickness: 15 mils.
 2. Permeance complying with ACI 302.2R.
 3. Permeance after conditioning when tested in accordance with ASTM E 1745 (where applicable): Less than 0.01 perms (gr/ft²/hr/in-Hg).
 4. Water vapor barrier tested by ASTM E-1745: Meets or exceeds Class A.

2.3 ACCESSORIES

- A. General: adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each type of vapor barrier.

- B. Pipe Boots: Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect.
- B. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION - BELOW-SLAB VAPOR BARRIERS/RETARDERS

- A. General: Install Vapor Barrier in accordance with manufacturer's instructions and ASTM E 1643. Place vapor barrier beneath all floor slabs
- B. Unroll Vapor Barrier with the longest dimension parallel with the direction of the pour.
- C. Lap Vapor Barrier over footings and seal to foundation walls.
- D. Overlap joints a minimum of six inches with top lap in direction of spreading concrete. Turn up layer at slab edges abutting walls. Seal with manufacturer's recommended tape or secure edge with non-corrosive termination bar.
- E. Seal all penetrations (including pipes, reinforcing steel, and permanent utilities) with manufacturer's pipe boot or vapor barrier manufacturer's recommended detail.
- F. Do not puncture vapor barrier. No punctures or unsealed penetrations are permitted.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides with tape.

End of Section

Section 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS
(TRADE CONTRACT REQUIRED AS PART OF 07 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. The work of this Section consists of fluid applied air and vapor barrier (non-permeable) membrane where shown on the Drawings, as specified herein, and as required for a complete and proper installation. System to include, but is not limited to:
1. Fluid-applied vapor impermeable membrane.
 2. Connections of the walls to the roof vapor retarder.
 3. Connections of the walls to the foundations.
 4. Air barrier transitions for storefront and door frames, louvers, and similar openings
 5. Air barrier system seals at piping, conduit, duct and similar penetrations.
 6. Air barrier system seals at Masonry ties, screws, bolts and similar penetrations.
 7. Foamed-in-place insulation for air barrier sealant at difficult and inaccessible areas.
 8. Joint sealant at concealed transitions of air barrier, and at abutting flashing,
- B. Furnish and install fluid (liquid), spray applied air and vapor barrier system (and insulation adhesive), with membrane transition and edging at all openings in exterior walls, in conjunction with windows, doors, penetrations, louvers, sheet metal flashing, roofing edges, fascia, eaves and similar penetrating and transition conditions of building envelope and as detailed on Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.

- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete walls.
- D. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit back-up and masonry veneer.
- E. Section 06 16 00 - SHEATHING: Wall sheathing.
- F. Section 07 21 00 - THERMAL INSULATION.
- G. Section 07 26 00 - VAPOR RETARDERS:
 - 1. Vapor barriers and in walls, floor assemblies and roof assemblies.
 - 2. Vapor barrier, seam tape, pipe boots, detail strip for installation under concrete slabs.
- H. Section 07 27 13 - MODIFIED BITUMINOUS SHEET AIR BARRIERS: Self-adhesive elastomeric sheet membrane air barrier system.
- I. Section 07 62 00 - SHEET METAL FLASHING AND TRIM.
- J. Section 07 92 00 - JOINT SEALANTS: Requirements for joint sealant and backing materials.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
 - 2. ASTM C 518 Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
 - 3. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 4. ASTM E 96 - Water Vapor Transmission of Materials.
 - 5. ASTM E 283 - Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors.
 - 6. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.
 - 7. ASTM E 1677 - Air Retarder Material or System for Low-Rise Framed Building Walls
 - 8. ASTM E 2178 - Air Permeance of Building Materials.
 - 9. ASTM E 2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
 - 10. SWRI - Sealant Specification.
 - 11. All applicable federal, state and municipal codes, laws and regulations for thermal insulation and vapor barriers.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees: Owner, Architect, Contractor, air barrier applicator's project superintendent, air barrier manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - a. Section 03 30 00 – Cast-in-Place Concrete
 - b. Section 03 45 00 - Precast Architectural Concrete.
 - c. Section 04 20 00 - Unit Masonry.
 - d. Section 05 50 00 - Metal Fabrications.
 - e. Section 06 16 00 - Sheathing.
 - f. Section 07 27 13 - Modified Bituminous Sheet Air Barriers.
 - g. Section 07 41 43 - Composite Roof Panels.
 - h. Section 07 62 00 - Sheet Metal Flashing and Trim.
 - i. Section 08 43 13 - Aluminum-Framed Storefronts.
 - j. Section 08 51 13 - Aluminum Windows.
 2. Agenda:
 - a. Review of shop submittal requirements.
 - b. Scheduling and sequencing of building envelope operations.
 - c. Review of staging and material storage locations.
 - d. Coordination of work by other trades.
 - e. Review of mock-up requirements.
 - f. Review of substrate preparation, compatibility of materials and Installation procedures.
 - g. Installation procedures for air barrier and flashings including surface preparation requirements and minimum curing periods.
 - h. Review connection methods of air barrier to doors, windows, storefront, louvers and similar product connections.
 - i. Protection of completed Work.
 - j. Establish weather and working temperature conditions to which Architect and Contractor must agree.
 - k. Emergency rain protection, foul weather and cold temperature procedures.

- l. Discuss process for manufacturer's inspection and acceptance of completed air barrier enclosure.
 - m. Review protection requirements of completed in-place air barrier.
 - n. Review procedures for field inspections, testing and repair procedures.
- C. Pre-installation meetings specified under related specifications:
 - 1. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 04 20 00 – UNIT MASONRY.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E 2178 - Air Permeance of Building Materials.
 - b. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.
 - c. Include statement that materials are compatible with adjacent materials proposed for use.
 - d. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.
 - 2. Shop Drawings:
 - a. Submit shop drawings of proposed mock-ups showing plans, elevations, isometric details, installation sequence, and connections to the test apparatus.
 - b. Show the locations and extent of air and vapor barrier system including details of typical conditions including:
 - 1) Intersections with other envelope systems and materials.
 - 2) Membrane counter-flashings.
 - 3) Bridging of gaps.
 - 4) Penetrations through barrier including conduits, pipes and similar items.
 - 3. Verification Samples:
 - a. Through-wall flashing membrane.
 - b. Transition membrane.
 - 4. Certificates:
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of each component of air barrier system.
 - b. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from

manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.

5. Test and Evaluation Reports:
 - a. Provide an Evaluation Report as the manufacturer's documentation confirming material has been evaluated and conforms to the requirements of the ASTM E2176 Standard for Air Barrier Materials.
 - b. Provide an Evaluation Report as the manufacturer's documentation confirming materials have been tested as an assembly and have passed the requirements of ASTM E2357 Standard Test Method of Determining air leakage in air barrier assemblies.
6. Manufacturer's Instructions:
 - a. Installation Instructions: indicate preparation, installation requirements and techniques, joint and crack treatment and application temperature range, product storage and handling criteria, and limitations of the material.
7. Source Quality Control Submittals:
 - a. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers.
8. Field Quality Control Submittals:
 - a. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.
9. Manufacturer Reports:
 - a. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use.
10. Special Procedure Submittals:
 - a. Written statement, signed by the air barrier applicator, stating that the Contract Drawings have been completely reviewed with an agent of the air barrier and vapor barrier system manufacturer; accompanied by a written statement from the manufacturer that the selected air barrier and vapor barrier system is proper, compatible, and adequate for the application shown.
 - 1) Manufacturer's review shall include recommendations for detailed conditions and specific application requirements for project. Copies shall be sent to Architect, Owner, General Contractor and application sub-contractor.
 - b. The applicator will notify the Architect and Owner in writing that the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected air barrier and vapor barrier system or the warranty requirements.

11. Qualification Submittals: Submit proof of License of the Contractor by ABAA (Air Barrier Association of America, Inc.) at the time of bidding and prior to commencing the work.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Bonds and Warranty Documentation: Submit manufacturer's warranties and guarantees as specified elsewhere herein this Section.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of fluid applied air barrier membrane.
 - C. Qualifications:
 1. Installer/Applicator:
 - a. General: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 - b. Submit proof of License of the Contractor by ABAA (Air Barrier Association of America, Inc.) at the time of bidding and prior to commencing the work.
 2. Testing Agencies: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).
- 1.8 MOCK-UPS
- A. Provide mock-up under provisions of Section 01 43 39 – MOCK-UPS.
 - B. Provide mock-up areas using air and vapor membrane system, minimum 200 square feet, demonstrating the minimum standard for the Work.
 - C. Locate mock-ups where directed and include all materials which are part of the air and vapor system. Incorporate as part of the mock-up area, substrate, window frame, attachment of insulation, and showing air and vapor barrier application details.
 - D. Allow 24 hours for inspection of mock-up by Architect. before proceeding with air/vapor barrier work. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.
 - E. Independent Third Party Testing of Mock-up:
 1. Air and Water Infiltration Testing: Test mock-up for air and water infiltration in accordance with ASTM E 1186 (air leakage location) or ASTM E 783 (air leakage quantification), and ASTM E 1105 (water penetration). Use smoke tracer to locate sources of air leakage. If deficiencies are found, repair or modify mock-up and retest until satisfactory results are obtained. Deficiencies

include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

- a. Perform the air leakage tests and water penetration test of mock-up prior to installation of cladding and trim but after installation of all fasteners for cladding and trim and after installation of other penetrating elements. For fasteners which would normally only be installed with cladding, install representative fasteners without cladding; intent is to perform testing with all types of penetrations in place.
2. Adhesion Testing: Test mock-up of fluid-applied and sheet applied materials for adhesion in accordance with ASTM D 4541 using a Type 1 pull tester except that the disk used shall be 100mm in diameter and the membrane shall be cut through to separate the material attached to the disk from the surrounding material. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance with ASTM D 4541. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report shall indicate whether this requirement has been met. Where the manufacturer has not declared a minimum adhesion value for their product/substrate combination, then the inspector shall simply record the value.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

B. Storage and Handling Requirements:

1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.10 SITE CONDITIONS

A. General: Maintain temperature and humidity recommended by the materials manufacturer before, during, and after application of air barrier.

1. Do not apply when ambient temperatures are at 20 degrees F., 24 hours prior to, during and 48 hours after application of air barrier.
2. Do not apply if frost exists on substrate.

B. Do not leave air barrier exposed to sunlight (ultra-violet light) for greater than 60 calendar days.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty: Provide manufacturer's standard product warranty, for a minimum 3 years from date of Substantial Completion.
- C. Special Warranty:
 - 1. Provide 2 year Applicator's warranty or bond which shall include removal and replacement of defective materials, and repairs or replacement of Owner's materials and products damaged due to failure of air and vapor barrier installation to resist air, water or moisture penetration.
 - a. Warrant work for a period of two years from the date work is certified as substantially performed in accordance with general condition of the contract.
 - 2. Promptly correct, at own expense, defects or deficiencies which become apparent within the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Henry Company, Huntington Park, CA. (Henry)., Product: "AirBloc32MR."
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Henry Company, Huntington Park, CA. (Henry).
 - 2. Tremco Inc., Beechwood OH. (Tremco).
 - 3. Carlisle Coatings & Waterproofing Inc., Wylie, TX. (Carlisle).
 - 4. W.R. Grace & Co., Construction Products Division, Cambridge MA. (Grace).

2.2 DESCRIPTION

- A. Regulatory Requirements: Comply with 2015 International Building Code with Massachusetts Building Code, Ninth Edition amendments: 780 CMR 13, Section 502.4.3 Air Barriers.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 PERFORMANCE/DESIGN CRITERIA

- A. General Performance Characteristics: The air barrier shall have the following characteristics:
 - 1. Continuous, with all joints made airtight.

2. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
 3. The air barrier shall be joined in an airtight and flexible manner to the air barrier material of adjacent systems, allowing for the relative movement of systems due to thermal and moisture variations and creep. Transition connections shall be made between the following:
 - a. Foundation and walls, including penetrations, ties and anchors.
 - b. Walls, windows, storefront, louvers, and doors.
 - c. Different wall systems, and fixed openings.
 - d. Wall and roof connections and penetrations
 - e. Walls, roof and floors over unconditioned space.
 - f. Walls, floor and roof across construction, control and expansion joints.
 - g. Walls, floors and roof to utility, pipe and duct penetrations.
 - h. Seismic and expansion joints.
 4. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made airtight.
- B. Material Performance Requirements: Provide materials which have an air permeance not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 inches water (1.57 psf) (0.02 L/m² @ 75 Pa.) when tested according to ASTM E 2178.
- C. Laboratory-Tested-Assembly Performance Requirements: Provide a continuous air and vapor barrier assembly that has an air leakage not to exceed 0.040 cubic feet per square foot per minute under a pressure differential of 0.3 in. water (1.57 psf) (0.20 L/ m² @ 75 Pa.) when tested in accordance with ASTM E 2357, and a vapor permeance of 1 perm (57 mg) or less when tested in accordance with ASTM E 96 using the desiccant method. Assembly shall perform as a liquid drainage plane flashed to discharge condensation or water penetration to the exterior. Assembly shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air and vapor seal materials at such locations, changes in substrate and perimeter conditions.

2.5 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.6 MATERIALS

- A. Air and Vapor Membrane: one component water based non-permeable elastomeric emulsion membrane, fire resistant and designed for permanent exposure, trowel or spray applied, having the following characteristics
 1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Henry Company, Product: "AirBloc 32MR"

2. Liquid air barrier: One component elastomeric membrane, spray applied, having the following characteristics:
 3. Air permeability: 0.0002 cfm/SF at 500 Pa @ 70°F.
 4. Water vapor permeance: 5 ng/Pa.m².s. [0.08 perms] (tested per ASTM E96 Method B).
 5. Chemical resistance: Alkalis and salt.
- B. Transition membrane (Self-Adhering): SBS modified bitumen, self-adhering sheet membrane complete with a cross-laminated polyethylene film, and having the following physical properties:
1. Thickness: 1.0 mm [40 mils] minimum consisting of composite sheet 0.9 mm (36 mils) of self-adhesive rubberized asphalt integrally bonded to 0.1 mm (4 mils) of cross-laminated, high-density polyethylene film.
 2. Air leakage: <0.005 L/m² at 75 Pa (ASTM E283-91).
 3. Vapor permeance: 2.8 ng/Pa.m².s., [0.05 perms] (ASTM E96).
 4. Elongation: 200 percent (ASTM D412-modified).
 5. Specified material: Blueskin SA as manufactured by Henry Company, or approved equal compatible with liquid air barrier.

2.7 ACCESSORIES

- A. Substrate primer. The type of primer and the installation of the primer shall follow the requirements of the manufacturer for the surface conditions.
- B. Termination sealant/mastic for fluid applied membrane: Single component, low VOC sealant or mastic formulated from polymers, plasticizers and manufacturer's proprietary additives and designed specifically for detailing and termination of the air barrier and transition membranes:
1. Henry Company, El Segundo CA; product, "HE925-BES Sealant".
 2. Tremco, Beachwood OH.; product, "ExoAir Termination Mastic".
 3. Carlisle Coatings & Waterproofing, Wylie, TX; product, "CCW LM-800XL".
- C. Polyether sealer for transitions and flashings: Low modulus type, Single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ±25 percent, equal to the following:
1. BASF (Sonneborn), product, "MasterSeal 150".
 2. STS Coatings, product "GreatSeal PE-150" Sealant.
 3. Chem Link, product "MetaLink".
 4. York Manufacturing, product: "LT-100 Polyether Sealant".
 5. Tremco, product "Dymonic FC".
- D. Low pressure polyurethane foamed-in-place insulation / air barrier sealant:
1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Fomo Products, Inc., Norton OH.

- b. Dow Chemical Company, Midland, MI.
 - c. Premier industrial Supply, Phoenix AZ.
 - d. Convenience Products, Division of Clayton Corp., Fenton MO.
 - e. Henry Company, El Segundo, CA.
2. Foamed-in-place insulation for air barrier sealant: Low pressure polyurethane foam sealant. Acceptable products include the following or approved equal:
 - a. Fomo Products, Inc., product: "Handi Foam" or "Handi-Seal".
 - b. Dow Chemical Company, product: "Great Stuff Pro".
 - c. Premier industrial Supply, product: "XtraFoam".
 - d. Convenience Products, Division of Clayton Corp., product: "Touch 'n Foam No Warp".
 - e. Henry Company, product: "NailTite NT-100".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify items which penetrate surfaces to receive air barrier and vapor barrier are rigidly installed.
 2. Verify surfaces are free of cracks, depressions, waves, or projections which may be detrimental to successful installation.
 3. Concrete Substrates: Notify the Contractor in writing if concrete substrate requires patching of holes over 1/2 inch in diameter or length and over 1/4 inch deep, by Section 03 30 00 - CAST-IN-PLACE CONCRETE. Do not proceed until patching is completed.
 4. Examine joints and transitions to other building materials. Verify surfaces and size of transitions are suitable for products specified herein.
 5. Report in writing defects in substrates which may adversely affect the performance of the air and vapor barrier.
 6. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Surface Preparation:
 1. Surfaces to receive air barrier shall be free of frost and loose or foreign matter which might impair adhesion of materials.

2. Prepare joints to receive foam air barrier sealant by brushing, scrubbing, wiping, scraping or grinding to remove loose mortar, dust, oil, grease, solvents, oxidation, mill scale and other contaminants which will affect adhesion and integrity of foam sealant.
3. Mortar joints in concrete block and form tie holes/voids in poured concrete shall be filled flush and struck smooth and allowed to be cured for a minimum of 24 hours.
4. Cracks in masonry and concrete wider than 1/4 inch wide shall be sealed with a strip of air barrier Membrane lapped a minimum of 3 inches on both sides of the crack.
5. Joints between panels of exterior grade gypsum, plywood and other panel type substrates up to 6 mm wide shall be filled with a trowel application of specified liquid air barrier and reinforced with a 2 inch wide strip of glass fiber tape or sealed with air barrier membrane prior to the application of liquid membrane.

3.3 APPLICATION

A. General:

1. Apply air barrier in strict accordance with manufacturer's written instructions, Specifications or recommendations.
2. Apply only when surfaces and ambient temperature are within limits prescribed by the material manufacturer.
3. Finished air barrier membrane shall be free of voids and imbedded foreign materials.
4. Do not allow air barrier membrane to cover or mark adjacent surfaces. Use masking materials if necessary.
5. Seal screws and similar penetrations in air vapor barrier.
6. Remove masking materials immediately after barrier has cured to hard surface film.
7. Clean and make good surfaces soiled or damaged by work of this section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.

B. Primer for Transition Membrane:

1. Apply primer for self-adhering membranes at rate recommended by manufacturer.
2. Apply primer to all areas to receive transition sheet by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by transition membrane during the same working day must be re-primed.

C. Transition Membrane (Self-Adhering Type):

1. Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps.
2. Tie-in to window frames, hollow metal door frames, storefront system, roofing system and at the interface of dissimilar materials.
3. Promptly roll all laps and membrane with a counter top roller to effect seal.

4. Ensure all preparatory work is complete prior to applying Primary Air Barrier.
- D. Primary (fluid applied) Air and Vapor Barrier:
 1. When transition membrane is installed, apply by spray a complete and continuous unbroken film of air and vapor barrier at a wet film thickness of 2.25 mm to 3 mm. Overlap transition membrane a minimum of 2 inches. Trowel around all projections ensuring a complete and continuous air seal.
 2. Immediately embed insulation into air and vapor barrier and press firmly into place to ensure full contact. Apply additional air and vapor barrier if allowed to skin over.
 3. Fully butter all joints of insulation panels with air and vapor barrier during installation, except at expansion joints.
 - E. Foamed-in-place insulation / air barrier sealant: Apply insulation in method to a uniform monolithic density without voids, in accordance with manufacturer's instructions.
 1. Apply application of foam for air barrier seal includes, but is not limited to:
 - a. Door frames, window frames, and similar penetrations in exterior walls.
 - b. Gaps, cracks, cavities and joints in the building envelope, not sealed with other forms of air boots, including electrical boxes and conduit, ducts, fans, and piping.
 - c. Where additionally indicated on Drawings.
- 3.4 INTERFACE WITH OTHER WORK
- A. Coordinate the work of this Section installation of windows and door frames. Ensure air and vapor barrier transitions from windows and door frames is completed.
- 3.5 REPAIR
- A. Do not permit adjacent work to damage work of this section. Damage to work of this section caused by other sections shall be made good by this section at the expense of the section which caused the damage.
- 3.6 FIELD QUALITY CONTROL
- A. Field inspection will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.
 - B. Non-Conforming Work: Repair punctures, damaged areas and inadequately lapped seams with a patch of air barrier membrane sized to extend 6 inches [150 mm] in all directions from the perimeter of the affected area.
 - C. Manufacturer Services: Make arrangements to have Manufacturer's representative (employed by manufacturer) on-site during work of this Section to periodically observe and review installation procedures. A minimum of 2 site visits are required.
- 3.7 CLEANING
- A. General: Clean work under provisions of Section 01 70 00 – EXECUTION.
-

1. Daily clean work areas; dispose of debris, and material scraps.
 2. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave exterior work areas in rake-clean condition.
- B. Control spills of fluid applied materials: Do not allow material to saturate ground, enter drains, runoffs, streams, lakes or ground water. Immediately absorb all spills with a dry inert material, such as sand or manufactured absorbents. Properly dispose of absorbent materials in compliance with all environmental regulations.
1. Report all spills into, or with the potential to reach, navigable (surface) waters of the United States or adjoining shorelines, as soon as there is knowledge of the spill, to the National Response Center. The criteria for reporting such incidents were set forth in 40 CFR 110 for oil discharges and 40 CFR 116 for hazardous substances discharges.

National Response Center
c/o United States Coast Guard (G-OPF) - Room 2611
2100 2nd Street, Southwest
Washington, DC 20593-0001

Toll Free Telephone: 800-424-8802

- C. Waste Management:
1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
 2. Dispose of liquid waste in accordance with all applicable regulations. Consult all regulations (federal, provincial, state, local.) or a qualified waste disposal firm when characterizing waste for disposal. Contact manufacturer for MSDS sheets for product information, and recommendations for proposal disposal. Utilize licensed waste disposal companies as may be required, the following phone numbers for national companies are provided for the Contractor's convenience only.
 - a. Safety Kleen, Plano TX., (telephone 800-669-5740).
 - b. Clean Harbors, Norwell MA., (telephone 800-422-8998).
 - c. Phillip Services Corporation (PSC), Houston TX., (telephone 800-726-1300).

3.8 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
- B. Do not expose air and vapor barrier membrane to sunlight for more than thirty days prior to enclosure.
- C. Protect installed membrane from all deleterious environmental conditions, and damage from construction. Maintain warrantable product with respect to Manufacturer's requirements; maintain "as new condition" until covered.

End of Section

Section 07 42 14
EXPOSED FASTENER METAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install preformed metal wall panel system which includes, but is not limited to:
 - 1. Non-insulated corrugated steel panel system.
 - 2. Non-insulated perforated and corrugated steel panel system.
 - 3. Related flashing adapters, copings, trim and filler components indicated as integral parts of the panel system or as designed.
 - 4. Sub-assemblies, anchorages, shims, furring, fasteners, gaskets, and sealant associated with the work of this Section.
 - 5. Shop-finished brake-metal through-wall flashing for cavity drainage at fiber cement wall panel system.
 - a. Provide tie-in to air and vapor barrier.
 - 6. Shop-finished brake metal trim components required as part of metal wall panel system.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD FORMED METAL FRAMING: Exterior steel framing and Z-channel furring.
- D. Section 05 50 00 - METAL FABRICATIONS.
- E. Section 06 16 00 - SHEATHING.
- F. Section 07 21 00 - THERMAL INSULATION.
- G. Section 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS.

H. Section 07 42 14 - EXPOSED FASTENER METAL WALL PANELS.

I. Section 07 92 00 - JOINT SEALANTS.

J. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS

K. Section 08 51 13 - ALUMINUM WINDOWS

1.4 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, and performance data.
 - a. Define panel lengths, widths, bow, camber and squareness tolerances.
 - b. Certification and copies of test results for all performance and fire tests specified under the Article entitled "System Description".
2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
3. Shop drawings:
 - a. Large scale design details of panel system showing attachment clips and brackets; and complete installation details. Provide complete details of all major interfaces and periphery conditions.
 - b. Shop drawings will also serve as field installation drawings and be complete with specific instructions for the application of the products, periphery trim and all sealant, lap strips and similar edge conditions, to insure a weather tight installation.
 - c. All Shop Drawings shall bear the registration stamp of a Professional Structural Engineer registered in Commonwealth of Massachusetts indicating compliance with Massachusetts State Building Code, Ninth Edition.
4. Verification samples:
 - a. 12 x 12 inch samples of panel with trim attached illustrating material and finish. Demonstrate color match with existing building panels.
5. Performance: Indicate how design requirements for loading and other performance criteria have been satisfied.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Minimum of 10 years of experience in manufacturing of insulated architectural metal wall panels.
- B. Installer Qualifications: Minimum of 5 years of experience in installation of wall panel systems of the type specified herein, and authorized by manufacturer.
- C. At least two weeks prior to commencing the work of this Section, conduct a pre-installation inspection by a representative of the metal wall manufacturer at the Project site. Coordinate time of inspection to occur prior to installation of metal wall panels.

1. Any additional work resulting from pre-installation or completed installation inspections shall be provided at no additional cost to the Owner.
 - D. Field inspection of completed installation to be performed by a representative of the metal wall manufacturer.
- 1.6 DELIVERY AND STORAGE AND HANDLING
- A. Deliver panels packaged to adequately protect from damage during shipment.
 - B. Protect panels for adverse job conditions prior to installation.
- 1.7 FIELD MEASUREMENTS
- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
- 1.8 WARRANTY
- A. Manufacturer's written warranty for wall panel systems, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 2 years from date of substantial completion of the General Contract. Failure due to defective materials or workmanship is deemed to include, but not to be limited to:
 1. Failures in operation of operating component or components.
 2. Leakage or air infiltration in excess of the specified standard.
 3. Deterioration of finish to an extent visible to the unaided eye.
 4. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the work of this Section or the Work as a whole.
 - B. Provide 20 year warranty on polyvinylidene flouride (PVDF) enamel finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Morin (a Kingspan Group Company), Bristol, CT.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Morin (a Kingspan Group Company), Bristol, CT.
 2. Centria Architectural Systems, Moon Township, PA.
 3. IMSA Building Products, Inc., Los Angeles CA.
 4. Metal Sales Manufacturing Corporation, Rancho Cucamonga CA.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: The metal panel system including required supports, trim and sealant shall meet all regulatory requirements for wind loading, water penetration, and air leakage and in addition the following criteria.
1. Wind Loading: Panel system and installation shall be designed to conform to the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as revised by *Massachusetts State Building Code*, Ninth edition.
 - a. Basic wind speed of 137 miles per hour (3 second gust), both positive (acting inward) and negative (acting outward) wind pressure loading.
 - 1) Building Risk Category: III.
 - 2) Building Exposure: C.
 - b. Panels shall have a deflection limit of $l/180$ for positive loading.
 - c. Structural design calculations shall be certified by a registered professional engineer and be submitted to verify load-carrying capacities of the panel system, including fastener calculations.
 2. Air Infiltration: Air infiltration of the panel assembly with insulation at 20 psf pressure shall be no more than 0.003 cfm/sq. ft. of panel, when tested in accordance with ASTM Test Procedure E283 by a recognized independent testing laboratory.
 3. Water Penetration: Water penetration of panel assembly with insulation at 13.24 psf for 15 minutes shall be 0 when tested in accordance with ASTM Test Procedure E331 by a recognized independent testing laboratory.
 4. Wall system assemblies shall be designed to support the dead loads, live loads, wind loads, and combinations loads, positive and negative as required by the governing laws and building codes with a maximum deflection of $l/175$ of the unsupported span of any assembly or 3/4 inches, whichever is less when tested at 40 pound per square foot for positive and negative wind loads.
 5. Design wall system, to withstand thermal expansion and contraction movements of component materials, without buckling, failure of joint seals, undue stress on members or fasteners, or other detrimental effects.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 MATERIALS

- A. Substrate: G-90 galvanized steel substrate, hot-dipped galvanized steel conforming to both ASTM A924 and ASTM A653, Grade A, having a minimum yield strength of 33,000 psi.
1. The galvanized steel shall be specified as having minimum spangle to assure proper adhesion and coating performance.
 2. The galvanized steel surface shall be properly cleaned and prepared with an approved pretreatment.
- B. Exterior Panels

1. Non-perforated Wall Panel System, Basis of Design: Morin (a Kingspan Group Company), product "Exposed C-37, 1/2 CA", corrugated exposed fastener system, Galvalume, in finish as scheduled on Drawings
 - a. Gauge of exterior panel shall be 20 gauge.
 - b. Panel width: 37-5/16 inches
 2. Perforated Wall Panel System, Basis of Design: Morin (a Kingspan Group Company), product "Exposed C-37, 1/2 CA", perforated and corrugated exposed fastener system, Stainless Steel, in finish matching non-perforated panels.
 - a. Gauge of exterior panel shall be 20 gauge.
 - b. Panel width: 37-5/16 inches.
 - c. Perforation Pattern; 1/4 inch holes: 23 percent open area – 1/2 inch hole spacing
- C. Accessories
1. Fasteners: Type 300 Series stainless steel, with 5/8 diameter combination neoprene bonded metal washers.
 - a. Exposed fasteners color-coated to match panels.
 2. Closures: Provide metal closures manufactured from material that is the same finish and color of the adjacent metal panels and furnished where shown on drawings.
- D. Subgirts: As shown on Drawings.
1. Panel system supplier shall provide all fasteners, girts, and framing to anchor panels to exterior wall framing.
 2. Space fasteners, girts and framing as required to resist indicated loads and to protect panels from oilcanning or deformation. Show compliance with requirements as part of delegated design submittals.
 - a. Fasteners, girts, and framing materials shall be compatible with metal panels and with substrates. If dissimilar materials and proposed, installer shall provide slip sheets, bituminous paint coating, or plastic spacers to prevent galvanic action.
 3. Thermally Broken Z Girts: Manufacturer's engineered shape fabricated from pultruded thermosetting, fire retardant, fiberglass reinforced isophthalic polyester resin size as shown on Drawings, thickness as required by manufacturers engineers calculations.
 - a. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, Manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1) Basis of Design: Advanced Architectural Products, Allegan, Michigan, product "SMARTci Systems, Inc -GreenGirt" engineered shape to meet structural requirements for application as detailed.
 - 2) Bedford Reinforced Plastics, Bedford, PA, product "ProForms" custom engineered shape to meet structural requirements for application as detailed.

- 3) Fibergrate Composite Structures, Dallas, TX, product "Dynaform Structural Shapes", custom engineered shape to meet structural requirements for application as detailed.
4. Apply sealant at thermally broken Z girt fastener penetrations and continuously along upper horizontal joint.
- E. Negative Pressure Clips (specifically designed for use with panel system) shall be used to assist in resisting high pressure conditions. The clips shall be 22 gage spring steel. No additional fasteners are required. Clips shall be located at each subgirt.

2.5 FLASHING AND TRIM MATERIALS

- A. Cavity through-wall brake metal flashing:
 1. Brake metal: Galvalume minimum 20 gage, having same finish and color of the adjacent metal panels.
- B. Termination and lap sealant (concealed conditions only): Polyether, single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ± 25 percent, equal to the following:
 1. BASF (Sonneborn), product, "Sonolastic 150".
 2. STS Coatings, product "GreatSeal PE-150" Sealant.
 3. Chem Link, product "MetaLink".
 4. York Manufacturing, product: "PE-150 Liquid Tape".

2.6 FACTORY FINISH

- A. Finish: Custom, shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
 1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluropon Classic II."
 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.

5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Inspect delivered materials upon receipt to insure that no damage has occurred during shipment.
- B. Inspect substrate where panels are to be installed and verify that substrate tolerances, as required in Article 1.04 references have been met.
- C. Do not start work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Verify that substrate layout complies with shop drawing layout.
- B. Report any variations and potential problems to the architect.
- C. Do not start work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Install metal panels, fasteners, trim and related items in conformance with approved drawings and performance requirements as set by system manufacturer.
- B. Erect panels plumb, level, and true. Maintain vertical and horizontal panel joints to uniform 9/16 inch dimension.
- C. Anchor panels securely in place accordance with manufacturer's approved shop drawings.
- D. Conform to panel manufacturer's instructions for installation of concealed fasteners.
- E. Install panels and trim members in accordance with manufacturer's approved shop drawings.
- F. Where panels come in contact with dissimilar materials, provide one coat of bituminous paint or caulking tape to insulate between dissimilar materials. Factory applied coatings, where not scratched or damaged, is acceptable as an insulation material between galvanized steel and aluminum.
- G. Install sealant materials in accordance with the instructions furnished by the panel manufacturer.
- H. Protect installed panels from abuse by other trades. The contractor shall be responsible for protecting the panels from wet cement, plaster, painting operations, and similar work which may stain or damage panels.

3.4 DAMAGED MATERIAL

- A. Repair or replace all damaged material. Ensure protection of completed or installed walls from damage by other trades.

3.5 CLEANING

- A. Remove all strippable film for all work as it is erected and prior to moving to the next portion or area.

End of Section

Section 07 42 24
PHENOLIC PANEL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 SUMMARY

- A. Supply and install pre-finished composite wood veneer panel exterior wall cladding and soffit system, including related accessories and concealed fasteners.
 - 1. Design, engineer, furnish and install, metal hat-shaped channels.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD FORMED METAL FRAMING: Exterior steel framing and Z-channel furring.
- D. Section 07 42 43 - COMPOSITE WALL PANELS: Composite aluminum panels.

1.4 SUBMITTALS

- A. Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's data sheet on each product to be used including:
 - a. Preparation instructions and recommendations.
 - b. Storage and handling requirements and recommendations.
 - c. Installation methods.
 - 2. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, and finish colors.
 - 3. Samples: Submit two complete sets of color swatches representing manufacturer's full range of available colors, grain patterns, vein contrast and materials for each panel finish specified.
 - 4. Installer Qualifications: Certification stating that installer is experienced in the installation of the specified products, and who has completed installations similar in extent and design with a record of successful performance.

1.5 QUALITY ASSURANCE

- A. Certified test results from independent testing laboratory substantiating specified performance characteristics and physical properties.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.
- B. Panel Storage: Place inspected panels in a well ventilated enclosed place. Lay panels on an elevated flat surface in a manner to prevent damage. Storage time shall not exceed five months after factory shipping date. Protective peel-off sheet shall be removed immediately after panel is installed.
- C. Open crate within 72 hours of material delivery. Remove extra top panel and inspect contents by lifting each panel vertically to prevent chafing of the decorative face. Protect materials during handling to prevent damage.

1.7 ENVIRONMENTAL CONDITIONS

- A. All boxes shall be opened and all components removed from the packaging and stacked flat with spacers between the pieces in their final environment for a minimum 3-4 days prior to installation.
- B. Do not install Prodema material under environmental conditions where it is likely to be immersed in water, or where the temperature is likely to exceed 120 degrees Fahrenheit for extended periods of time.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Basis of Design: Prodema S.A. B San Miguel 9, SPAIN, as represented by FORMAS, Inc., Miami, FL., product: "Prodex."
 - 1. Engineering criteria: The manufacturer for wall panel system shall employ the services of a qualified structural engineer, registered to practice in the Commonwealth of Massachusetts, to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.
 - 2. Dead loads: As required by applicable building code.
 - 3. Live Loads: As required by applicable building code.
 - 4. Wind loading: panel system shall conform to Massachusetts State Building Code, Ninth Edition, (780 CMR 1609):
 - a. Basic Wind Speed: 137 miles per hour. (three-second-gust).
 - b. Building Risk Factor: III.
 - c. Exposure: C.
 - 5. Water infiltration: Static Water Infiltration (ASTM E331-83) at 15.0 psf (77.5 mph wind and 2.88" H₂O) with a water spray rate of five (5) gallons per hour

per square foot minimum for 15 minutes, no uncontrolled water infiltration on roomside.

6. Static Air Infiltration: Air/moisture barrier air infiltration shall not exceed 0.06 cfm per square foot at a pressure differential of 1.57 psf when tested in accordance with ASTM E 283.
 7. Design wall system, to withstand thermal expansion and contraction movements of component materials, without buckling, failure of joint seals, undue stress on members or fasteners, or other detrimental effects.
- B. Fire Performance Characteristics: Provide metal composite wall systems with the following fire test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.

2.2 MATERIALS

- A. Prodema product "Prodex" composite wood veneer exterior wall panel.
1. Panels: Grade A rotary cut hardwood veneer from farmed forests and bonded to a bakelite core.
 - a. Fire Rating: Class A in accordance with ASTM E-84 criteria for flame spread 20 and smoke development 70 and Class 1 (M1) fire rating in accordance with UNE-EN 2372.
 2. Color: As subsequently selected by Architect, from manufacturer's full range of species and colors.
 3. Panel Thickness: 8 mm.
 4. Panel Dimensions: As indicated on Drawings, and confirmed by approved shop drawings.
- B. Provide manufacturer's standard exposed fasteners, finished in up to 2 colors as selected by the Architect.
- C. Inverted hat channel: Prodema Model No. 200, black anodized finish.
- D. "Hat shaped" furring channels: Size as shown on Drawings, thickness and grade as required by structural design calculations, hot-dip galvanized steel.
1. Dietrich Industries, Inc., Pittsburgh PA.
 2. Gold Bond Building Products/National Gypsum Company, Charlotte NC.
 3. Marino Industries Corp., South Plainfield NJ.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify compatibility of different metallic surfaces in contact with each other to protect against electro-chemical corrosion.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Protect metal surfaces in contact with concrete, masonry mortar, plaster or other cementitious surface with isolation coating.
- C. Do not use caulking, gaskets or sealants on panel face or edges.

3.3 INSTALLATION

- A. Secure panels to vertical furring.
- B. Maintain indicated opening at base and top of panels.
- C. Prior to mounting, pre-drill 8mm diameter holes 15 to 45 mm from the panel edge.
 - 1. Do not over tighten fasteners and damage the outer coating.
 - 2. Space fasteners at 24 inches on center, unless otherwise recommended by panel manufacturer.

3.4 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 81 20 - CONSTRUCTION WASTE MANAGEMENT.

End of Section

Section 07 42 43
COMPOSITE WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish and install the following:
 - 1. Rout and return metal composite faced panel rain screen system including vertical walls.
 - 2. Related flashing adapters, copings, trim and filler components indicated as integral parts of the panel system or as designed.
 - 3. Thermal bridging reduction sub-framing-assemblies, anchorages, shims, furring, fasteners associated with the Work of this Section
 - 4. Pre-finished brake metal cavity wall flashing.
 - 5. Coordinate back up support for extruded aluminum batten furnished and installed by Section 08 43 13 – ALUMINUM FRAMED STOREFRONT.

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Structural wall framing.
- D. Section 07 21 00 - THERMAL INSULATION: Mineral wool insulation.
- E. Section 07 54 19 – PVC ROOFING: Membrane Roofing and related insulation.
- F. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Counter flashings and cap flashing at roof.
- G. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.

1.3 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. AAMA 501 - Methods of Test for Metal Curtain Walls.
 - 2. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
 - 3. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and storefront, Curtains Walls and Doors.

4. ASTM E 330 Structural Performance of Exterior Entrance and storefront, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
5. ASTM E 331 - Test method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
6. NFPA 285 – Standard Fire Test Method For Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components (Intermediate Scale Multi-story Apparatus Test).

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements:
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
2. Shop Drawings:
 - a. 1/4 inch scale elevations indicating panel jointing.
 - b. Large scale design details of wall system; indicating sizes, types, and gauges of all metal components; expansion provisions, sealant details, indicating types and thickness of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 - c. Design engineering shall be the responsibility of the wall systems manufacturer; details may vary from those indicated on the Contract Drawings.
3. Selection Samples:
 - a. Sample card indicating Manufacturer's full range of coating colors available for selection by Architect.
 - b. Provide physical samples as requested by Architect for initial selection of colors and finishes
 - c. Manufacturer's sample boards for sealant colors, for selections by the Architect.
4. Verification Samples:

- a. After receipt of selected standard colors from the Architect, submit at least two 12-inch long pieces of major metal extruded components of the systems, and 12 by 12 inch samples of finished aluminum sheet used for trim components, prefinished in the specified finish system in selected colors.
 5. Certificates: Indicate how design requirements for loading and other performance criteria have been satisfied.
 6. Manufacturer's Instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
1. Installer/Applicator: Minimum of 7 years documented experience demonstrating previously successful work of the type specified herein , and approved by product manufacturer.
 2. Professional Engineer Qualifications: Design structural elements under direct supervision of Professional Engineer experienced in design of this Work and licensed in the Commonwealth of Massachusetts

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Extended Correction Period: Project specific Manufacturer's written warranty for composite panel system, covering repair or replacement of any system which leaks, or exhibits defects in materials, finish, design, within 5 years from date of Project Substantial Completion. Failure due to defective materials or workmanship is deemed to include, but not to be limited to:
 - 1. Failures in operation of operating component or components.
 - 2. Deterioration of finish to an extent visible to the unaided eye.
 - 3. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the work of this Section or the Work as a whole.
- C. Special Finish Warranty: Provide 20 year warranty on polyvinylidene flouride enamel finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Composite Metal Panel System Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
 - 1. Firestone Metal Products, Anoka, MN.
 - 2. Laminators Incorporated, Hatfield PA.
 - 3. Lymo Construction Company, Merrimack NH.
 - 4. Sobotec Ltd., Hamilton Ontario, Canada.
 - 5. Universe Corporation, Bridgeton, MO.

2.2 DESCRIPTION

- A. System General Description: Rout and Return panel system with attachment system which will allow for exterior removal of any individual panel within the erected system for damage replacement or access of structure behind the panel, without disturbing adjacent panels.
 - 1. System shall be a cavity rain screen design and provide a reveal joint as detailed on Drawings.
- B. System shall comply with the applicable provisions of the "Metal Curtain Wall, Window, Storefront, and Entrance Guide Specifications Manual" published by AAMA, and ANSI/AAMA 302.9 requirements for aluminum windows.
- C. System shall not have visible fasteners, telegraphing or fastening on the panel faces or any other compromise of a neat and flat appearance.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. General Performance: The metal panel system including required supports, trim and sealant shall meet all regulatory requirements for wind loading, water penetration, and air leakage and in addition the following criteria.
1. Engineering criteria: The manufacturer for wall panel system shall employ the services of a qualified structural engineer, registered to practice in the Commonwealth of Massachusetts, to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.
 2. Dead loads: As required by applicable building code.
 3. Live Loads: As required by applicable building code.
 4. Wind Loading: Roofing system and installation shall be designed to conform to the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as revised by *Massachusetts State Building Code*, Ninth edition.
 - a. Basic wind speed of 137 miles per hour (3 second gust), both positive and negative wind pressure loading.
 - 1) Building Risk Category: III.
 - 2) Building Exposure: C.
 5. Design wall system, to withstand thermal expansion and contraction movements of component materials, without buckling, failure of joint seals, undue stress on members or fasteners, or other detrimental effects.
- B. Fire Performance Characteristics: Provide metal composite wall systems with the following fire test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84:
 - a. Flame spread index: 25 or less.
 - b. Smoke developed index: 450 or less.

2.4 COMPOSITE PANELS

- A. Manufacturer:
1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Alcoa Architectural Products, Eastman GA.
 2. Composite Metal Panel System Acceptable Manufacturers: Subject to compliance with the requirements specified herein and capability to provide specified finishes, manufacturers offering similar products may include the following:
 - a. Alcoa Architectural Products, Eastman GA., product "Reynobond FR", with fire resistant rated core.
 - b. 3A Composites, Mooresville, NC., product "Alucobond Plus" with fire resistant rated core.

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- c. Mitsubishi Kasei America, Inc., Chesapeake, VA, product "Alpolic FR", with fire resistant rated core.
- B. Materials:
- 1. Aluminum Sheet: Smooth surface coil-coated sheet, ASTM B209, 3005 T5 Aluminum alloy.
 - 2. Aluminum Extrusions: ASTM B 221, 6063 T5 Aluminum.
 - 3. Fire Resistant (FR) Panel Core: Thermo-set polymeric core, fire-retardant per ASTM E 84, with flame-spread index of 25 or less and smoke-developed index of 450 or less.
- C. Composite aluminum panels, as manufactured by one of the following, or approved equal. Panels shall be two sheets of 0.020 aluminum sandwiching a core of extruded thermoplastic formed in a continuous process with no glues or adhesives between dissimilar materials.
- 1. Panel Thickness: 4mm (approximately 3/16 inch).
 - 2. Surface Texture: Smooth.
 - 3. Bond Integrity: No failure of bond between core and faces and no cohesive failure of core when tested in accordance with ASTM D 1781 at minimum of 22.5 in-lb per inch.
- D. Panel Facing, Factory-applied Finishes specified herein below.

2.5 SUPPORT STRUCTURE:

- A. Subgirts: As shown on Drawings.
- 1. Panel system supplier shall provide all fasteners, girts, and framing to anchor panels to exterior wall framing.
 - 2. Space fasteners, girts and framing as required to resist indicated loads and to protect panels from oilcanning or deformation. Show compliance with requirements as part of delegated design submittals.
 - a. Fasteners, girts, and framing materials shall be compatible with metal panels and with substrates. If dissimilar materials and proposed, installer shall provide slip sheets, bituminous paint coating, or plastic spacers to prevent galvanic action.
 - 3. Thermally Broken Z Girts: Manufacturer's engineered shape fabricated from pultruded thermosetting, fire retardant, fiberglass reinforced isophthalic polyester resin size as shown on Drawings, thickness as required by manufacturers engineers calculations.
 - a. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, Manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1) Basis of Design: Advanced Architectural Products, Allegan, Michigan, product "SMARTci Systems, Inc -GreenGirt" engineered shape to meet structural requirements for application as detailed.
 - 2) Bedford Reinforced Plastics, Bedford, PA, product "ProForms" custom engineered shape to meet structural requirements for application as detailed.

- 3) Fibergrate Composite Structures, Dallas, TX, product "Dynaform Structural Shapes", custom engineered shape to meet structural requirements for application as detailed.
 4. Apply sealant at thermally broken Z girt fastener penetrations and continuously along upper horizontal joint.
- B. Connectors and Anchors:
1. Connectors used with Cold-Formed Steel Framing Members: Conform to ICC ES AC261
 2. Screw Fasteners: Stainless steel as instructed by manufacturer.
 - a. Thermoset Polyester coating that exhibits 1,000 hours of salt spray beyond stainless steel anti-corrosiveness.
 - b. Minimum No. 14 self-drill hex-head screw fastener to be used to attach vertical rail to horizontal rail.
 - c. Steel Studs:
 - 1) Self-drill hex-head TEK screw fasteners of sufficient length.
 - 2) Minimum three threads must penetrate steel stud members.

2.6 ACCESSORIES

- A. Stainless Steel Drill Screws: Of sufficient lengths and sizes to securely fasten support structure to building wall framing members, and as follows:
1. Screws complying with ASTM C 1002 for fastening to steel members less than 0.033 inches (0.84 mm) thick.
 2. Screws complying with ASTM C 954 for fastening to steel members from 0.033 to 0.112 inches (0.84 to 2.84 mm) thick.
- B. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

2.7 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. All panels shall be formed to specified dimension with tolerances to accommodate expansion and contraction between panels and structure members.
1. Maintain indicated reveals at all horizontal and vertical joints.
- C. Accessory and trim components shall be factory fabricated and ready for installation.
- D. Fabricate panels in a manner that will eliminate condensation on the interior side. Design joints between panels to form shiplap seal, allow for individual panel movement.
1. Provide factory-assembled, wall panel units fabricated to dimensions and joint configurations indicated on Drawings.
 2. Form panel lines, breaks and angles sharp and true with surfaces that are free from warp or buckle.

3. Fabricate from sharply cut edges, with no displacement of aluminum sheet or protrusion of core.
 4. Tolerances shall accommodate expansion and contraction between panels and structural members. Maintain the indicated reveal depth for both horizontal and vertical joints as indicated.
- E. Panel Tolerances:
1. Flatness: Maximum allowable distortion: 1/32 inch in 24 inches (0.794 mm in 600mm) in any direction.
 2. Thickness: $\pm 1/32$ inch.
 3. Length and Width: +0, -1/8 inch.
 4. Squareness: 1/64 inch per lineal foot.

2.8 FABRICATION

- A. All panels shall be formed to specified dimension with tolerances to accommodate expansion and contraction between panels and structure members. Maintain indicated 3/4 inch deep reveal at all horizontal and vertical joints.
- B. Accessory and trim components shall be factory fabricated and ready for installation.
- C. Fabricate panels in a manner that will eliminate condensation on the interior side. Design joints between panels to form weathertight seals.
1. Provide factory-assembled, wall panel units fabricated to dimensions and joint configurations indicated on Drawings.
 2. Form panel lines, breaks and angles sharp and true with surfaces that are free from warp or buckle.
 3. Fabricate from sharply cut edges, with no displacement of aluminum sheet or protrusion of core.
 4. Tolerances shall accommodate expansion and contraction between panels and structural members. Maintain the indicated reveal depth for both horizontal and vertical joints as indicated.

2.9 FACTORY FINISH

- A. Finish: Custom, shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluorpon Classic II."

3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Maximum deviation from vertical and horizontal alignment of substrate shall be no more than 1/4 inch in 20'-0".
 2. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Evaluation and Assessment: At least two weeks prior to commencing the work of this Section, conduct a pre-installation inspection by a representative of the metal wall manufacturer at the Project site. Coordinate time of inspection to occur prior to installation of metal wall panels.
 1. Any additional work resulting from pre-installation or completed installation inspections shall be provided at no additional cost to the Owner.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Verify that substrate layout complies with shop drawing layout.
- C. Report any variations and potential problems to the architect.
- D. Do not start work until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Comply with manufacturer's product data including product technical bulletins, product catalog installation instructions, and product carton instructions.
- B. Furring and framing: Accurately align and attach furring and framing in strict compliance with framing manufacturer's recommendations and approved shop drawings.

1. Frame wall openings with additional framing members at perimeter of openings as needed.
 2. Align holes in framing members to facilitate electrical conduit and piping work.
 3. Provide all needed connections and accessories provide a complete structural system.
 4. Provide all needed members for proper fastening of aluminum track for panel system.
- C. Bracing: Provide bridging and bracing as recommended by manufacturer, as necessary, and as indicated on approved shop drawings. Provide kick-back bracing perpendicular to plane of framing system and securely anchored to building structure as needed to comply with specified performance requirements.
- D. Install aluminum track system as recommended by manufacturer. Installed track to receive panels shall be even, smooth, sound, clean, and free from defects detrimental to panel installation.
- E. Erect panels plumb, level, and true.
- F. Anchor panels securely in place accordance with manufacturer's approved shop drawings.
- G. Conform to panel manufacturer's instructions for installation of concealed fasteners.
- H. Provide reticulated foam at weeps. Fasten directly behind weep holes in manner to keep in place during installation and prevent wind uplift from forcing the material to migrate away from the weep holes.
- I. Install sealant and backing material at all joints within panel system and perimeter of system.
1. Do not block weep holes with sealant.
 2. Install joint bead back-up in all joints.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 3. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
 4. Apply specified sealant materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - b. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.

- c. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
- d. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
- e. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.4 TOLERANCES

- A. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- B. Erect the composite metal panel systems plumb and level, free of warp or twist.
 - 1. Maximum misalignment of two adjoining members abutting in plane: 1/32 inch
 - 2. Maximum variation from plumb or level: 1/16 inch per 10 feet, non cumulative
 - 3. Maximum offset from true dimensional alignment: 1/8 inch.

3.5 FIELD QUALITY CONTROL

- A. Field inspection will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Non-Conforming Work: Damaged and unapproved work shall be removed and replaced.
- C. Manufacturer Services: Field inspection of completed installation to be performed by a representative of the composite panel manufacturer and submit a written report.
 - 1. Installer shall correct deficiencies noted in report and additional deficiencies identified by Architect's observations.
 - 2. Replace damaged panels and accessories which cannot be repaired in field.

3.6 CLEANING

- A. General: Clean work under provisions of Section 01 70 00 – EXECUTION.
 - 1. Refer to AAMA 601.1 for cleaning and maintenance of panels.
- B. After completion of the work of this Section:
 - 1. Remove equipment rubbish, and debris from the work area.
 - 2. Remove temporary protective films.
 - 3. Clean exposed panel surfaces promptly after completion of installation in accordance with recommendations of panel and coating manufacturer.
 - 4. Clear weep holes and drainage channels of obstructions, dirt, and sealant.
 - 5. Leave immediate site area in rake-clean condition.
 - 6. Protect and maintain wall system in clean condition during construction.

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 07 54 19
POLYVINYL-CHLORIDE (PVC) ROOFING
(TRADE CONTRACT AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Furnish and install the following:
1. Fully adhered polyvinyl chloride (PVC) sheet roofing system.
 - a. Provide oil resistant membrane at Food Service exhaust vents.
 2. Mechanically fastened to metal decking, thermal barrier below roof insulation (where no concrete).
 3. Overlayment (recovery) board beneath membrane, and cement board.
 4. Roof insulation as part of roof system, provided under this Section.
 5. Vapor barrier, loose laid and self-adhering types.
 6. Flashing at all penetrations through the roofing system and at all materials which abut roofing system.
 7. Roof edging.
 8. Site Mock-up
- B. Flood testing of installed roofing system (at areas having roof pavers).
1. Contractor will engage an independent testing agency to observe flood testing and examine decks and terminations for evidence of leaks during flood testing.
- C. Install the following furnished under individual sections.
1. Install acoustical insulation at flutes in acoustical metal decking, furnished under Section 05 30 00 - METAL DECKING
- D. Provide walkways in places of traffic leading from roof access points (ladders, stairs, doorways) to, and around rooftop mechanical equipment.
- E. Provide manufacturer's pre-construction and final inspection as specified herein. These inspections are to be included in the base bid; additional required weekly inspections, or work incurred as a result of the final inspection shall be without additional cost to the Owner.
1. Work of this Section additional includes providing Owner assistance in the preparation and submittal of roof installation acceptance certification as may

be necessary in connection with fire and extended insurance coverage of roofing and associated work.

2. Provide weekly roofing inspection reports during the course of roofing work.

1.3 RELATED REQUIREMENTS

- A. Section 01 43 39 – MOCK-UPS.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 04 20 00 - UNIT MASONRY.
- E. Section 05 12 00 - STRUCTURAL STEEL FRAMING
- F. Section 05 30 00 – METAL DECKING
- G. Section 06 10 00 - ROUGH CARPENTRY: wood blocking, curbing and nailers.
- H. Section 07 21 00 - THERMAL INSULATION: Interior building insulation, below roof deck.
- I. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Metal flashing, trim, scuppers, gutters, and downspouts.
- J. Section 07 72 00 – ROOF ACCESSORIES: Roof pavers and pedestals.
- K. Section 07 92 00 - JOINT SEALANTS: Sealant other than those specified in this Section 07 54 19.
- L. Division 23 - PLUMBING: vents.
- M. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Prefabricated curbs for roof mounted mechanical equipment.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 1. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 2. ASTM D4434 / D4434M - Poly(Vinyl Chloride) Sheet Roofing.
 3. FM: Roof Assembly Classifications and Loss Prevention requirements I-28 and I-29S.

4. ASTM D7877 - Standard Guide for Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes.
 5. FM 4470 - Corrosion Resistance Testing.
 6. All applicable federal, state and municipal codes, laws and regulations for fire-resistance roof ratings.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. American Society of Civil Engineers, ASCE-7 - Minimum Design Loads for Buildings and Other Structures.
 2. NRCA - Roofing and Waterproofing Manual, Latest edition.
 3. Roof System Manufacturer's published Technical Specifications, Bulletins and Advisories.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Roofing and Flashing Pre-Installation Conference: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 00 02 – ROOFING AND FLASHING FILED SUB-BID REQUIREMENTS.
- C. Scheduling:
1. Notify manufacturer's representative 48 hours in advance for deck acceptance. Plan the lay-up of roofing membrane with respect to deck slope; avoid situations where excessive drainage could pass into completed roofing.
 2. The Roofing applicator shall maintain communication with roofing manufacturer's representative to inform of progress and to schedule period sample testing.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Manufacturer's written and notarized certification that roofing membrane furnished for project has been treated with specified "dirt-repellent" acrylic coating.
 - b. Material Safety Data Sheets for products submitted.
 2. Manufacturer's specimen warranties: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

3. Review statement: Written statement, signed by the roofing applicator, stating that the Contract Drawings have been reviewed by an agent of the roofing system manufacturer; accompanied by a pre-installation written statement from the manufacturer that the selected roof system is proper, compatible, and adequate for the application shown.
 - a. Provide certification from roofing manufacturer that system meets all identified code requirements.
 - b. The roofing applicator will notify the Architect and Owner in writing if the existing conditions when exposed are in conflict with the Contract Documents for the proper application of the selected roofing system or the warranty requirements.
4. Construction schedule and work area plan indicating work sequence and duration of the roofing work in each area; indicate methods and duration of temporary waterproofing, thermoplastic membrane, and flashing work. Provide adequate detail showing all staging and storage areas and any effect of the work at each building access. Coordinate schedule and site access with the other trades.
5. Project roofing superintendent's resume and project experience list for similar installations.
6. Shop drawings:
 - a. Setting plans for insulation, showing types of insulation, thickness and direction of slopes.
 - b. Fully dimensioned 1/4-inch scale plans of roof. Indicate on plans, major areas of patching existing roofing and all areas of new roofing. Plans shall show changes in level, key locations of details, all roof penetrations, roof slopes and direction of slope. Indicate on plans any areas of proposed staging and material storage on roof.
 - c. Large scale design details, minimum of 1-1/2 inch per foot scale, showing perimeter flashing conditions and penetrations. Details shall show dimensions of actual measurements taken at the project and reflect actual conditions; manufacturer's standard preprinted details will not be accepted as substitute for shop drawings.
 - d. Tapered Insulation Shop Drawings: Submit scaled plans showing all proposed tapered insulation layouts in accordance with the Basis of Design (BOD) shown on the Roof Drainage Plans. Show the following on the tapered insulation plans:
 - 1) Cross-section of each tapered insulation system identifying tapered slope and thickness of each insulation layer.
 - 2) Arrows indicating directions of slope (new slope at new areas and existing slope at existing adjacent areas of roofing assembly to remain) at all locations.
 - 3) Height of the final roofing assembly (i.e., top of finished PVC membrane elevation), relative to the top of the structural deck, at all roofing assembly high and low points, perimeter wall/roof curb, and penetrations.
 - 4) Available flashing height at all roofing assembly high and low points, perimeter wall/roof curb, and penetrations.
 - e. Walkway Pad Plan: Contractor shall submit a walkway pad layout plan for review and approval by Architect.

7. Verification samples:
 - a. Provide 8-1/2 by 11 inch samples of roofing membrane and membrane flashing materials.
 - b. Provide 12 inch long samples of each metal flashing type.
 - c. Furnish additional samples are requested by the Architect.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 1. Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.
 2. Manufacturer's warranties: Include coverage of materials and installation.

1.7 QUALITY ASSURANCE

- A. General:
 1. The manufacturer's authorized technical representative shall provide four pre-final inspections occurring during the course of roofing work to ensure roofing work is in accordance with manufacturer's requirements.
 2. The manufacturer's authorized technical representative shall provide a final inspection at the completion of the project to insure, that the project has been completed in accordance with the manufacturer's requirements. Upon approval and acceptance of the project, furnish to Owner, implemented manufacturer's warranty certification.
 3. Submit Manufacturer's field quality control reports of field inspections, including, revised "as-built" shop drawings and manufacturer's final punch list.
 4. All roofing shall be as described in this Section and shall be provided and approved by the roof system manufacturer. Any materials not manufactured or provided by manufacturer shall have written approval from the manufacturer stating the materials are acceptable and are compatible with the other materials and systems required.
 5. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. The roof system manufacturer's technical specifications, bulletins and advisories shall be considered a part of this specification and should be used as a reference for specific application procedures and recommendations. Where a conflict does exist between the manufacturer's written specifications and those procedures specified in this Section, the more stringent requirements meeting the Manufacturer's minimum requirements for the provided warranty shall apply.
 1. Roofing Filed-Subcontractor shall provide at no additional cost to this contract, all additional labor and materials to conform to manufacturer's required installation procedures which are necessary to provide a total roofing system which is in full compliance with manufacturer's warranty requirements, including additional materials, installation procedures, manufacturer's inspections, sample testing and other requirements.
- C. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of roofing system.
- D. Qualifications:

1. Roofing manufacturer: Minimum of 10 years documented experience demonstrating previously successful work of the type specified herein.
2. Installer/Applicator: trained and authorized by product manufacturer for installation of specified system.
 - a. Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.

1.8 MOCKUPS

- A. At least two weeks prior to the start of each type of roofing and flashing work, provide samples of flashing on the building where directed by the Architect, as described below. Notify the Architect at least seven days before construction of the sample so that the Architect may have a representative present during the construction of the sample. Do not start work until the Architect has approved the mockup.
 1. Construct mockups of the following:
 - a. Typical roof system.
 - b. Roof Drain.
 - c. Roof base flashing interface with through-wall flashing.
 - d. Roof base flashing interface with storefront.
 - e. Typical flashing condition
 - f. Typical mechanical curb.
 - g. Roof vapor barrier transition with wall air and vapor barrier at roof edge.
- B. Coordinate with related work to construct a complete mockup of each condition.
- C. In general, field mockups may become a permanent part of the work, after approval. The Contractor is responsible for reconstructing any mockups that are not approved along with any associated construction.
- D. Mockups shall establish both the technical and the aesthetic qualities for this Section of the work and will be used to set a standard for acceptance for this work. Reconstruct the mockups as many times as necessary to meet the Architect's approval, without additional cost to the Owner.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers or packages with labels and package seals intact and legible.
- B. Store all materials in accordance with the manufacturer's recommendations. Store rolled goods on clean, raised platforms. Store other materials in dry areas, protected from water and direct sunlight.
- C. Do not expose stored curable roofing materials and accessories, including uncured flashing, adhesives, sealants and pourable sealer, to a constant temperature in excess of 80 degrees Fahrenheit.
- D. Provide continuous protection of stored materials against deterioration for duration of project.

- E. Store insulation on dunnage and completely cover with a water-resistant breathable material. Provide weights to prevent wind damage to insulation.
- F. Distribute any materials stored on roof levels for immediate use to prevent concentrated loads that would impose excessive strain on deck or structural members. Protect roof stored materials to prevent displacement by the wind and protect from exposure to inclement weather and sun.
- G. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.10 ENVIRONMENTAL REQUIREMENTS

- A. Apply roofing in dry weather; do not install roofing in inclement weather or when precipitation is predicted with greater than 20 percent possibility.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Apply roofing in ambient temperature approved by roof system manufacturer.

1.11 WARRANTY

- A. Manufacturer's Warranty: Deliver to the Owner upon completion of the work of this Section, a conditional warranty for the roofing system, on the work of this Section agreeing to promptly repair the roofing as necessary to prevent penetration of water through it.
 - 1. Warranty shall cover product quality, performance, and workmanship for a period of 20 years.
 - 2. Warranty shall include total roofing system, insulation and membrane flashings.
 - 3. Warranty shall provide coverage for maximum peak gust for a wind speed of 90 miles per hour.
- B. Applicator's special warranty: Applicator shall supply Owner with a separate 2 year workmanship warranty or bond. In the event any work related to roofing, flashing, or metal is found to be within the Applicator warranty term, defective or otherwise not in accordance with Contract Documents, the Applicator shall repair that defect at no cost to Owner. Applicator's warranty obligation shall run directly to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Sika Sarnafil Inc., Canton, MA.
 - 1. Fully adhered roofing: Sika Sarnafil, Inc., "G410 Energy Smart" system.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Bond Cote Corporation, Pulaski, VA.

2. Duro-Last Roofing, Inc., Saginaw, MI.
3. Sika Sarnafil Inc., Canton, MA.

2.2 SYSTEM DESCRIPTION

- A. Fully Adhered polyvinyl chloride (PVC) roofing system, including insulation and substrate, shall meet Underwriters Laboratories, Inc. Fire Hazard Classification "Class A" roof.
- B. Regulatory Requirements: Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.
- C. Performance Requirements
 1. Wind Loading: Roofing system and installation shall be designed to conform to the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as revised by *Massachusetts State Building Code*, Ninth edition.
 - a. Basic wind speed of 137 miles per hour (3 second gust), both positive and negative wind pressure loading.
 - 1) Building Risk Category: III.
 - 2) Building Exposure: C.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 ROOFING MATERIALS

- A. Membrane: 0.060 inch thick glass-fiber-fabric-reinforced plasticized polyvinyl chloride (PVC) conforming to ASTM D-4434 (latest edition), Type II, Grade 1, equal to Sika Sarnafil type "G410" membrane.
 1. Sheet width: Nominally 6 feet wide sheets (full-width sheets).
 2. Sheet width: Nominally 3 feet wide sheets (half-width sheets) at Salient corners and edge conditions.
 3. Roofing membrane shall have conform to the following minimal properties:

<u>Property</u>	<u>ASTM Test Method</u>	<u>Resultant Value</u>
Felt Weight:		9 ounces per square yard.

Elongation at Break, % M. D. ¹ & C.M.D. ¹	D751	250 & 220
Seam Strength, % of original ²	D751	Pass
Retention of Properties After Heat Aging	D3045	--
Tensile Strength, % of original	D751	Pass
Elongation, % of original	D751	Pass
Tearing Resistance, lbf (N)	D1004	22 (98)
Low Temperature Bend, -40°F (- 40°C)	D2136	Pass
Accelerated Weathering Test (Florescent Light UV exposure), Hours	G154	10,000
Cracking (7x magnification)	--	None
Discoloration (by observation)	--	Negligible
Crazing (7x magnification)	--	None
Linear Dimensional Change, %	D1204	-0.01
Weight Change After Immersion in Water, %	D570	1.7
Static Puncture Resistance	D5602	Pass
Dynamic Puncture Resistance, ft-lbf (J)	D5635	Pass

1. Roof Membrane Color: Manufacturer's standard 'EnergySmart Tan' surface color, having the following characteristics:
 - a. Initial reflectivity: 0.73
 - b. Initial emissivity: 0.85.
 - c. Initial Solar reflective index (SRI): 89.

B. Secondary Roofing Membrane (Oil-Resistant Type, localized at food service exhaust): 0.060 inch thick glass-fiber-fabric-reinforced plasticized polyvinyl chloride (PVC) conforming to ASTM D-4434 (latest edition), Type II, Grade 1, equal to Sika Sarnafil type "G410" membrane, conforming to ASTM D-4434, Type II, Grade 1.

1. Sheet width: Nominally 3.5 feet wide sheets (half-width sheets).
2. Roofing membrane shall have conform to the following minimal properties:

Property	ASTM Test Method	Resultant Value
Tensile Strength:	D-638	1600 lbf.
Tear Resistance:	D-1004	14 lbf./in.
Breaking Strength:	D-751	270 lbf./in.
Elongation at break:	D-638	250 percent, MDxCD
Seam Strength:	D-638	80 percent of breaking strength.

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|-----------------------------------|-------|---|
| Heat Aging,
Tensile Strength | D-638 | Retaining 95 percent of tensile strength for heat aged at 176 degrees F. for 7 days. |
| Heat Aging,
Minimum Elongation | D-638 | Retaining 90 percent of original strength for heat aged at 176 degrees F. for 7 days. |
3. Roof Membrane Color (exposed): Manufacturer's standard white/Tan membrane with "Tan" color (oil resistant surface) exposed when installed, having the following characteristics:
 - a. Initial reflectivity: 0.73
 - b. Initial emissivity: 0.85.
 - c. Initial Solar reflective index (SRI): 89.
 - C. Flashing membrane: 0.060 inches thick (1.2 mm), plasticized PVC, fiberglass reinforced, ASTM D-4434, Type II, Grade 1. having a minimal tensile strength of 1600 psi when testing in compliance with ASTM D-638.
 1. Color: "Lead Gray", or "Copper Brown", as selected by Architect..
 - D. Coated metal flashing: PVC laminated to 25 gage steel, with a zinc coating supplied by the hot-dip process conforming to ASTM A525 or A526, A90 or G90 coating weight standard equal to Sanaclad.
 1. Prefabricated edge metal.
 2. Color: "Lead Gray", or "Copper Brown", as selected by Architect..
 - E. Securement discs:
 1. Discs: 26 gage 3 inch square SAE 1010 steel with a AZ 55 galvalume coating, punched on center for securement of membrane.
 2. Fasteners: #12 corrosion-resistant fastener to attach insulation boards to metal decking with a modified buttress thread, and shank diameter of approximately 0.168 inch (4 mm) and a thread diameter of approximately 0.214 inch (5 mm). The driving head has a diameter of approximately 0.435 inch (11 mm) with a #3 Phillips recess for positive engagement.
 - F. Cant Strips, tapered edge strips and flashing accessories: Types recommended by manufacturer of polyvinyl chloride material, provided at locations indicated and at locations recommended by manufacturer, including adhesive tapes, flashing cements, and sealants.

2.5 ROOFING INSULATION

- A. General: Insulation shall be approved by the roof manufacturer, and shall be UL listed and FM approved.
 1. Roof insulation is included as a system component under the specified "Total System" warranty and therefore shall either be furnished by the roofing manufacturer or be otherwise in compliance with the requirements of the roof system warranty
- B. Typical Roof Insulation: Polyisocyanurate foam insulation manufactured with HCFC-free blowing agent and bonded to glass fiber reinforced facers on top and

bottom surfaces during the manufacturing process. Insulation shall conform to property requirements of ASTM C1289, Type II.

1. Acceptable manufacturers: Subject to acceptance of roofing manufacturer and the following specification requirements:
 - a. Atlas Roofing Corporation, Atlanta, GA.
 - b. The Dow Chemical Co., Midland, MI.
 - c. Hunter Panels, Portland ME.
 - d. Johns Manville Roofing System, Denver, CO.
 - e. Carlisle Syntec, Carlisle PA.
 - f. Firestone Building Products Co., LLC, Indianapolis, IN.
 2. Performance Criteria:
 - a. Long Term Thermal Resistance (LTTR) R-value per inch (as determined by ASTM C1289-11a, or later): R = 5.6 per inch.
 - b. Thickness to provide R-value required:
 - 1) Minimum R-value: R36.
 - c. Density: 2.0 pounds per cubic foot (ASTM D-1622).
 - d. Compressive strength: 20 psi (ASTM D1621).
 - e. Moisture vapor transmission: Less than 1 perm (ASTM E-96).
 - f. Water absorption: Less than 1 percent per volume (ASTM C209).
 - g. Provide factory-tapered insulation system as required to meet elevations and slopes shown on drawings or as required by membrane manufacturer, which ever is more stringent. Provide cants and crickets at drains as necessary.
- C. Roof insulation beneath Paver/Pedestal areas:
1. High compressive strength rigid insulation: Closed cell extruded polystyrene foam board, square edge, conforming to ASTM C 578, Type VI, with a compressive strength of 40 pounds per square inch when tested in accordance with ASTM D 1621.
 - a. Minimum R-value: 5 per inch thickness.
 - b. Thickness: As indicated on Drawings.
 - c. Acceptable products include but are not limited to:
 - 1) Cetco North America, product "XPS40."
 - 2) DiversiFoam Products, product "CertiFoam 40".
 - 3) Dow Chemical Corp., "Styrofoam" brand, product "High Load 40".
 - 4) Kingspan Insulation LLC., "GreenGuard XPS 40 PSI Board".
 - 5) Owens Corning, Foamular brand, product "Foamular 400 XPS"
- D. Insulation for Acoustical Deck Fluting:
1. Acoustical mineral fiber or glass fiber insulation, minimum 3/4 pound per cubic foot density, complying with ASTM E 84/UL 723 flame spread 25 or less and smoke developed 50 or less, unfaced, comprised of rotary process fibers bonded with formaldehyde-free thermosetting resin.
 - a. Expanded Polystyrene (EPS) flute fillers are not acceptable as equal.

2. Custom fabricate insulation batts to suit metal deck flute depth and width and supply in rolls ready for installation
3. Acceptable manufacturers:
 - a. ModulRTS, Paris ON, Canada, product: "Protec Metal Deck Flute Filler".
 - b. Johns Manville, Denver CO.: product: "SG" Series "Spin-Glas SG 30".
 - c. Owen's Corning, Toledo OH., "Thermafiber" brand, product: "Top Stop".

2.6 THERMAL BARRIER

- A. Thermal barrier: UL fire resistance rated, ASTM C79 'Type X' board, 5/8 inch thick, of largest sizes to minimize joints, and with tongue and grooved edges:
 1. USG Sheetrock brand "Firecode Core Gypsum Sheathing".
 2. Gold Bond brand "Fireshield Jumbo Sheathing".
 3. LaFarge brand "FireCheck Sheathing"
- B. Overlayment (recovery) board: 1/2 inch thick complying with ASTM C 1177 and FM 4450, Class I, non structural glass mat faced, noncombustable, water-resistant treated gypsum core panel.
 1. Acceptable manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. CertainTeed Corporation, Valley Forge PA., product: "GlasRoc Roof Board"
 - b. Georgia-Pacific Building Products, Atlanta, GA, product: "DensDeck Roof Board".
 - c. United States Gypsum Company, Chicago, IL, product: "Securock Glass-Mat Roof Board".

2.7 VAPOR BARRIER

- A. Vapor barrier (loose laid type): Sarnafil product: "Sarnavap- Vapor Retarder PE10" (or approved equal), 10 mil thick polyethylene loose laid vapor barrier sheet.
- B. Vapor barrier (self-adhering type): Sarnafil product: "Sarnavap-Self-Adhered Vapor Retarder". A 32 mil thick composite sheet consisting of a high-density polyethylene grid laminated between two layers of polyethylene film bonded to SBS modified bitumen, and self- adhesive on the underside.
 1. Primer: Sarnafil product "Sarnavap-Self-Adhered Primer" is required for non-metal decks.
 2. At metal decks provide manufacturer's recommended galvanized metal plate attached to deck, spanning flutes at conditions where vapor barrier membrane has an end lap between flutes.

ACCESSORIES

- C. Fasteners:
 1. For roofing system components: Steel fastener with fluorocarbon coating, complying with FM 4470 corrosion resistance test.. Minimum thread diameter

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- 0.22 inches and minimum shank diameter of 0.172 inches, as recommended by roofing manufacturer. Nail type fasteners are not permitted.
- a. Fasteners may not be visible on batten roofs or in exposed deck areas. Fasteners to be installed beneath recovery board.
2. For ACQ pressure preservative treated (PT) wood: Flat head type 304 or 316 stainless steel only, wood screws and carriage bolts, of the appropriate sizes for specified wind loading. Aluminum, galvanized steel, and coated metal fasteners are prohibited with PT wood.
- D. Flat securement bars: 1 inch wide, aluminum or galvanized steel bar or extruded aluminum, 1/8 inch thickness, pre-punches at 12 inches on center; bar shall have a G90 coating (steel).
 - E. Insulation fastening plates, minimum 3 inches square.
 - F. Wind uplift securement bars: 14 gage hot-galvanized dipped U shaped bar, 1 inch wide by 1/8 inch wall thickness, prepunched at 12 inches on center.
 - G. Adhesive: Roofing manufacturers contact adhesive.
 - H. Roof metal: As required by manufacturer's shop drawings.
 - I. Walkway pads: Pedestrian traffic bearing, heat weldable rooftop walkway pad, 1/4 inch thick by 24 inch width. Pads shall be fabricated from recycled membrane material, injection molded with drainage canal network on pad's underside, and 60 mil (1.5 mm) thick heat-welded tabs.
 - J. Sealant: Single component gun-grade moisture-cured polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C- 920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I; with a minimum movement capability of +35/-35 percent, equal to Sika, product "Sikaflex 1a", in manufacturer's standard colors as selected by the Architect.
 - K. Miscellaneous materials: Best grade or quality as furnished or approved by the roofing manufacturer for the specific application.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify edge nailers, curbs and penetrations are in place prior to roofing, so that the roof system can be installed as continuously as possible.
- C. Verify the roof deck, and related surfaces are clean, smooth, flat, free of depressions, waves, or projections, properly sloped to drains, and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify deck surfaces are dry and free of snow or ice. Confirm dry deck by moisture meter with 12 percent maximum moisture content.

- F. Any condition requiring correction or completion shall be corrected or completed prior to the installation of the roofing system. Notify Contractor of unacceptable conditions.
- G. Do not proceed until defects are corrected.
- H. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

- A. Carefully broom clean substrate immediately prior to roofing application.
- B. Where surface joints at roof and wall substrates exceed 1/4-inch width, fill flush with surface with pourable sealer or insulating foam before proceeding with the installation.

3.3 EMERGENCY MATERIALS AND PROCEDURES

- A. Maintain continuous temporary protection prior to and during installation of new roofing system. Do not leave unfinished roof areas uncovered over-night or during inclement weather.
 - 1. Provide temporary protective sheeting over uncovered deck surfaces.
 - 2. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights or temporary fasteners.
 - 3. Do not permit traffic over unprotected or repaired deck surface.
- B. Maintain on site equipment and materials necessary to apply emergency temporary coverage in the event of sudden storms or inclement weather.
- C. Do not install more insulation than can be covered by roofing system in the same workday. Do not apply more roofing than can be properly fastened and sealed in the same workday. Ensure that water does not flow beneath any completed sections of the roofing system, provide temporary closures.
- D. Roofing Subcontractor is fully responsible for all damage due to water penetration occurring during the Work of this Section.

3.4 INSTALLATION - GENERAL

- A. The entire work of this Section shall be performed in accordance with the best standards of practice relating to trades involved.
- B. Follow local, state and federal regulations, safety standards and codes. When a conflict exists, the more restrictive document shall govern.
- C. Follow insurance underwriter's requirements acceptable for use with specified products or systems.
- D. Review all special conditions, such as at projections, at connections to sheet metal gravel stops, flashings, and similar materials with the Roofing Manufacturer, submit the Roofing Manufacturer's recommendations and details to the Designer for approval.
- E. Special Cautions:

1. Do not use oil-based or plastic roof cement.
2. Do not subject polymeric materials to contact with petroleum, grease, oil, solvents, vegetable or mineral oil, nor animal fat. Prevent contact with hot pipes, and ducts.
3. Cements and bonding adhesive contain petroleum distillates and are extremely volatile and flammable. Avoid breathing vapors and do not use near fire or flame.
4. Ensure that welding and bonding surfaces are dry during installation.

F. Pre-drill deck to receive fasteners.

3.5 THERMAL BARRIER INSTALLATION

- A. Install perpendicular to the steel roof deck with joints staggered and occurring over the crests of the roof deck. Secure to deck with adhesive applied at a rate of 0.04 gallons per 100 square feet.
1. Provide thermal barrier at steel deck roof substrate surfaces. Do not provide at concrete deck.

3.6 INSTALLATION – VAPOR BARRIER

- A. Ensure that concrete substrates have cured for at least 28 days, and have a relative humidity moisture content acceptable to roof manufacturer.
1. Do not install when it is raining or snowing, or over wet/humid surfaces
 2. Substrate surfaces shall be clean and dry.
- B. Install self-adhering vapor barrier where detailed and indicated:
1. Install vapor barrier primer prior to installation of self-adhered vapor barrier over substrates for 100 percent of roofing surface. Comply with manufacturer's minimum ambient and surface application temperature requirements. Apply primer by brush, roller or spray at coverage rates recommended by manufacturer for substrate surface to receive primer. Permit primer to fully dry prior to application of self-adhered vapor barrier.
 2. Apply self-adhered vapor barrier over cured primer, starting at the bottom of the slope. Unroll vapor barrier onto the substrate without adhering for alignment. Overlap each preceding sheet by 3 inches (75 mm) lengthwise following the reference line and by 6 inches (150 mm) at each end. Stagger end laps by at least 12 inches (300 mm). Do not immediately remove the silicone release sheet.
 - a. On metal decks use a galvanized steel plate (6 inch width minimum) secured to roof deck to support the membrane end lap between metal flutes ensuring a complete end lap seal.
 3. Once sheets are aligned, peel back a portion of the silicone release sheet and press the membrane onto the substrate for initial adherence. Hold vapor barrier, tight and peel back the release sheet by pulling diagonally.
 4. Use a 75 pound (34 kg) roller to press vapor barrier down into the substrate including the laps. Finish by aligning the edge of the roller with the lower end of the side laps and rolling up the membrane. Do not cut the membrane to remove air bubbles trapped under the laps. Squeeze out air bubbles by pushing the roller to the edge of the laps.

- C. Install loose-laid vapor barrier where detailed and indicated in accordance with manufacturer's instructions. Overlap edges by at least 4 inches. Seal all overlapped joints in vapor barrier with manufacturer's recommended vapor barrier tape.

3.7 INSTALLATION - INSULATION

- A. Install only as much insulation as can be covered with roofing membrane and completed before the end of the day's work, or before the onset of inclement weather.
- B. Place the constant thickness insulation of first layer and the subsequent tapered insulation to the required slope pattern and cants for drainage, in accordance with manufacturer's instructions.
 - 1. Stagger layers a minimum of 12 inches in both directions.
- C. Neatly fit insulation to all penetrations, projections, and nailers. Loosely butt edges and ends of insulation with gaps not greater than 1/4 inch.
- D. Secure insulation to substrate with mechanical anchors of type and spacing indicated by membrane manufacturer; but in no case provide less than one anchor per 4 square feet of surface area, or less anchorage than required by FM "Loss Prevention Data Sheet 1-28".
 - 1. At acoustical decking, fasteners are to penetrate at high ribs in deck ONLY. Minimize projection of fasteners into deck at required fastening depth recommended by manufacturer.

3.8 INSTALLATION – RECOVERY BOARD

- A. Install using fully-adhered installation over insulation, apply adhesives in accordance with manufacturer's recommendations for calculated negative wind loading.
 - 1. Insulation fasteners to be concealed by recovery board.
- B. Neatly fit insulation to all penetrations, projections, and nailers. Loosely butt edges and ends of insulation with gaps not greater than 1/4 inch.

3.9 INSTALLATION - MEMBRANE

- A. General: Begin application at the highest point of the highest roof level and work to the lowest point. Proceed in a work sequence to minimize construction traffic on completed areas of roofing.
 - 1. Design intent for batten roofs is for the roof laps to be set equal distance and perpendicular to the roof edge and battens placed at seams.
- B. Apply membrane and adhesives in accordance with manufacturer's instructions.
 - 1. Additionally install second layer of PVC sheet roofing as pads beneath paver pedestals. Heat weld into place.
- C. Roll out membrane, free from wrinkles or tears. Inspect sheet for defects as it is being rolled out. Place sheet into place. Align sheet with previous sheet to obtain a lap width of not less 4-1/2 inches.

- D. Make cutouts in membrane for protrusions such that when the skirts on the factory fabricated accessories, when welded to the deck membrane, will cover the cutouts. Fasten around cutouts with approved fasteners.
- E. Clean and dry welding joint areas of both membrane sheets. Weld membrane as recommended by manufacturer without wrinkles and voids. Apply pressure to the lap to ensure contact.
- F. Heat weld skirt of membrane accessories and flashing. Welded seams shall be 3 inches wide minimum using machined welding equipment, and 4 inches with hand welding equipment. Make a close and visual inspection for the full length of each field weld.
 - 1. Inspect all lap edges, repair all unsealed areas, voids and fishmouths.
- G. Provide additional membrane securement at expansion joints, curbs, skylights, and similar roof top penetrations, at interior wall and penthouse perimeters, and at any angle change which exceeds 2 inches in on horizontal foot.
 - 1. Weld polyvinyl chloride flashing over installed fastening plates as recommended by roofing manufacturer, and in no case provide flashing of less than 6 inches in width and at ends of flashing, provide a minimum 2 inch space from edge of plate.
- H. Extend membrane up cant strips and a minimum of 8 inches onto vertical surfaces.
- I. Provide oil resistant PVC membrane (secondary membrane) surrounding all food service exhaust vents. Membrane to cover curbing at vents, and extending a minimum of 3 feet from curb over primary roof membrane. Fully adhere secondary membrane to primary roofing membrane, and heat weld all seams along perimeter.
- J. Install termination bars with screw fasteners located 6 or 12 inches on center. Install roofing manufacturer's recommended sealant along top and bottom edges of termination bar.

3.10 WALKWAYS

- A. Install walkways at all traffic concentration points (including but not limited to roof hatches, access doors, rooftop ladders, and similar conditions), leading to and surrounding roof-top equipment, and at all additional locations identified on Drawings.

3.11 FIELD QUALITY CONTROL

- A. General: Field inspections will be performed under the provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Owner's testing: At the owner's discretion, he/she may engage a testing agency to perform testing of the roofing assembly, including but not limited to the following:
 - 1. Flood testing of drain assemblies.
 - 2. Flood testing of roof paving areas
 - 3. Infrared imaging of the roofing assembly
 - 4. Moisture content testing of roofing materials

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- C. Fastener Pull-out testing. Prior to installation of roofing membrane, obtain a independent testing agency approved by the Architect for each separate roofing area pull out resistance. Report findings to Architect and the roofing manufacturer. Perform testing testing per ANSI/SPRI FX-1-2001 - Standard Field Test Procedure for Determining the Withdrawal Resistance of Roofing Fasteners, without additional cost to the Contract.
1. Testing frequency: Ten tests per initial 50,000 square feet (or less) and five additional pullouts for each additionally 50,000 square feet, or portion thereof for each section of roof.
- D. Heat Welded Seam Testing:
1. Test cuts: Provide test cuts through seams and joints as representative sample of workmanship. For each welding machine used, provide not less than three test cuts per day of roofing work. Identify on roof plan locations of all test cuts. Label each test cut by a unique identifier, including date of cut.
 2. Verification procedure: Cutting a 1 inch wide strip of the membrane through a heat-welded seam. Each end of the sample is then pulled in opposite directions until failure. Acceptable samples result in failure of the membrane prior to separation of the weld. The contractor shall date and retain each sample on site throughout the duration of the project to allow for inspection by roofing manufacturer, Architect, and Owner.
 3. Frequency: As required by the roofing manufacturer but no less than three per day, or every time the machine is reset or restarted. Additionally test hand-welded seams a minimum of three times per day.
- E. Field Quality Control - Flood testing
1. Prerequisites prior to flood testing procedures:
 - a. Receipt and distribution of Factory Representative's inspection report and acceptance of waterproofing installation.
 - 1) Perform all repairs necessitated by factory representative's report prior to commencement of flood testing procedures.
 - b. Receipt of written confirmation from Structural Engineer of Record that loading conditions resulting from specified flood testing procedures is acceptable and will not damage or endanger in-situ structure.
 - c. Installed waterproofing shall be fully complete (all discovered repairs made) and in-place for a minimum period of 48 hours prior to commencement of flood testing process.
 - d. Fully protect and prohibit all traffic from exposed waterproofing surfaces at all times, except as required for inspections, repairs of waterproofing and flood testing procedures.
 - 1) Provide temporary protection layer to protect membrane from ultra-violet light (UV) exposure, future operations and other trades as required. Protect waterproofing as necessary to comply with manufacturer's written requirements regarding UV light exposure limits.
 2. Flood testing general requirements: comply with ASTM D 5959-98r05 *Standard Guide for Flood Testing Horizontal Waterproofing Installations*, manufacturer's written requirements and recommendations, as modified by the following:

- a. Plug drains and provide necessary barriers to contain water.
 - b. Flood waterproofed deck with minimum 2-1/2 inches (64mm) head of water, and not exceeding 6 inches (152mm). Maintain clearance of at least 2 inches (51mm) from top of sheet flashings. Check for leaks after 48 hours has expired. If leaks are present, drain deck and allow membrane to dry. Repair waterproofing as required. Permit repairs to 'set' for a minimum period of 24 hours and retest.
 - c. Protect waterproofing surfaces immediately following flood testing. If the flood test is delayed, provide a temporary protection layer to protect the membrane from UV exposure, future operations and other trades.
3. Prepare a written report of flood testing, and submit to Architect within 7 calendar days following test. Report results of tests, both successful and unsuccessful. In addition to results, report shall include date of test, project name, list of products being applied and tested, name of applicator, name of Contractor, and conditions causing failure of waterproofing in event of an unsuccessful test.
- a. In event of a unsuccessful test, include repair and correction procedures employed; and retest reports.
4. Roof Drain Testing: Perform testing in compliance with While ASTM D5957 - Standard Guide for Flood Testing Horizontal Waterproofing Installations.
- a. Procedure: Block roof drain to be tested and flood the drain sump to a minimum 1 inch of water and minimum 3 inch at drain for a period of 24 hours to simulate water backup from a clogged drain.
 - b. Frequency: Three randomly selected drains per individual roof areas.
 - c. Submit flow rates from tests.
- F. Roofing Filed-subcontractor to correct all deficiencies in roof as determined by roof sample analysis, testing, and as prescribed by roof system manufacturer. Should additional samples be required, these cost will be borne by the roofing applicator.

3.12 CLEANING

- A. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- B. Repair or replace defaced, or disfigured finishes caused by the work of this Section.

3.13 PROTECTION

- A. Provide special protection or avoid traffic on completed work. Contractor is responsible to restore to original condition, or replace, work and roofing materials damaged by work of other trades.
- B. Avoid traffic over completed roofing surfaces. Do not use roof surfaces for storage or work areas. Protect new and existing roof surfaces with smooth 5/8 in. thick (minimum) plywood runways where access is required, and ensure full protection of new and existing roofing surfaces against mechanical damage. Notify the Architect immediately, and in writing, if anyone abuses or damages roofing or flashing components.

End of Section

Section 07 62 00
SHEET METAL FLASHING AND TRIM
(TRADE CONTRACT AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Aluminum flashings and running sheet metal work, for all non-specified locations in conjunction with the roofs.
 - 2. Cap flashings, in conjunction with roofing system sheet membrane base flashings.
 - 3. Stainless steel through wall flashing.
 - 4. Formed brake-metal work.
 - 5. Sealant in conjunction with sheet metal work specified herein.
- B. Furnish stainless steel through wall flashing and tie-in accessories occurring in masonry construction to be installed under Section 04 20 00 – UNIT MASONRY.

1.3 RELATED REQUIREMENTS

- A. Section 01 43 39 - MOCKUPS: Requirements for exterior wall mock-up assembly requiring work of this Section.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 04 20 00 - UNIT MASONRY: Installation of through wall flashing furnished by this Section 07 62 00.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, nailers.
- F. Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.

- G. Section 07 54 19 – POLYVINYL CHLORIDE (PVC) ROOFING: Sheet membrane flashings for flanges of curbs, and sheet membrane roofing and flashing system.
- H. Section. 07 71 00 - ROOF SPECIALTIES: Factory fabricated and finished roof edging.
- I. Section 07 92 00 - JOINT SEALANTS: Sealant and backing material not specified herein
- J. Flashing sleeves and collars for mechanical and electrical items protruding through roofing: By respective trade sections furnishing same.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM B 209 - Specification for Aluminum Alloy, Sheet and Plate.
 - 2. ASTM B 221 - Specification for Aluminum Extrusions.
 - 3. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 - 4. ASTM D 2178 - Asphalt Impregnated Glass Mat for Roofing and Waterproofing.
 - 5. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.
 - 6. FS QQ-A-250d - Aluminum and Aluminum Alloy, Plate and Sheet.
- B. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. SMACNA - Architectural Sheet Metal Manual 6th Edition, referred to herein as "Sheet Metal Manual".
 - 2. NRCA - Roofing and Waterproofing Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's data sheets for each metal type and accessories furnished hereunder, include material specifications, performance data, physical properties and finishes.
 - 2. Certification: Provide certifications that materials and systems comply with the specified requirements for the use indicated.
 - 3. Shop drawings:
 - a. Fully dimensioned large scale design details showing material profiles, splices, flashing terminations and other jointing details, fastening methods and installation details. Indicate material type, sizes, and weights or gages. Indicate extent of adjacent work specified under other Sections of the Specifications.
 - b. Fully detail methods of relieving stresses due to thermal movement, including sealing of expansion seams.

- c. All details bearing dimensions of actual measurements taken at the project.
 - 4. Selection Samples:
 - a. Metal sample chips, indicating Manufacturer's full range of finish colors for factory finishes available for selection by Architect.
 - b. Manufacturer's sample boards for sealant colors.
 - 5. Provide the following LEED submittal items:
 - a. All relevant supporting documentation, as required by LEED for Schools v4 and as detailed in Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
 - b. A completed LEED Materials Reporting Form, per Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
 - B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
- 1.6 QUALITY ASSURANCE
- A. Company specializing in fabrication and installation of sheet metal flashing work with minimum 5 years documented experience.
 - B. Flashing and sheet metal applicator, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
- 1.7 MOCK-UP
- A. Provide mock-up elements for field panel in accordance with Section 01 43 39 – MOCKUPS at exterior location where directed by Architect. Mock-up will demonstrate quality of work, construction methods, relationship to other work.
- 1.8 PRE-INSTALLATION CONFERENCE
- A. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 05 40 00 – COLD-FORMED METAL FRAMING.
 - B. Installer of the Work of this Section is required to attend pre-installation conference specified under Section 07 54 19 – POLYVINYL CHLORIDE (PVC) ROOFING.
- 1.9 DELIVERY, STORAGE AND HANDLING
- A. Store preformed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
 - B. Prevent contact with materials during storage which may cause discoloration, staining, or damage.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the installation of flashings and sheet metal work with the various trades responsible for installing interfacing materials, and install the work at appropriate times so as not to delay the progress of related work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Through-wall Flashing materials: Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface and having 2D Finish (dull, cold rolled, having a minimum thickness: 28 gage (0.016 inch) thick.
 - 1. Provide shop-fabricated preformed and soldered end dams.
 - 2. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
- B. Termination Bars for Flexible Flashing: Stainless Steel bars 1/8 inch by 1 inch, predrilled at 9 inches on center.
- C. Exposed to view aluminum flashing and trim: FS QQ-A-250d sheet aluminum, mill finish, having a minimum thickness as specified herein below, for applications where indicated:
 - 1. Exposed to weather flashings and trim: 0.050 inch thick
 - 2. Aluminum Finish:
 - a. Polyvinylidene Fluoride (PVDF), Kynar 500 shop applied three coat resin based, high performance thermoplastic organic coating in custom non-standard color to match Architect's sample, conforming to AAMA 605.2, NAAMM - Metal Finishes Manual, and the following.
 - 1) Resin base of 70 percent PVDF by weight, Atochem North America, Inc., product "Kynar 500" or Ausimont USA. product "Hylar 5000".
 - 2) Finish Coating shall be manufactured as one of the following products:
 - a) Glidden Company; product "Visulure".
 - b) Morton International; product "Fluoroceram CL".
 - c) PPG Industries Inc.; product "Duranar XL".
 - d) Valspar Corp., product: "Flurothane".
 - b. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with acid chromate-fluoride-phosphate conversion coating, in accordance with Aluminum Association method AA-C12C42.
 - c. Primer: Corrosion resistant, epoxy or urethane based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - d. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 0.70 to 0.80 mil dry film thickness.
 - e. Top Coat: Polyvinylidene fluoride enamel clear top coat averaging 0.45 to 0.55 mils dry film thickness.
 - 3. Color and Appearance: Provide custom color to match Architect's sample. Architect's color sample will be a dark bronze however, it will NOT be considered "exotic", "polychromatic", "pearlescent" or "metallic".

2.2 ACCESSORIES

- A. Termination and lap sealant (concealed conditions only): Polyether, single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ± 25 percent, equal to the following:
1. BASF (Sonneborn), product, "Sonolastic 150".
 2. STS Coatings, product "GreatSeal PE-150" Sealant.
 3. Chem Link, product "MetaLink".
 4. York Manufacturing, product: "PE-150 Liquid Tape".
- B. Nails shall not be smaller than N^o.2 of 12 stub gauge (1.109 inches), with large flat heads, and of sufficient length to penetrate the wood nailers a minimum of 7/8-inch. Nails shall be stainless steel.
- C. Screws: Stainless steel wood screws, of sizes most appropriate for the specific application, and equipped with soft neoprene washers.
- D. Joint Sealant for termination and lap sealant (concealed conditions only): Polyether, single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ± 25 percent, equal to the following:
1. BASF (Sonneborn), product, "Sonolastic 150".
 2. STS Coatings, product "GreatSeal PE-150" Sealant.
 3. Chem Link, product "MetaLink".
 4. York Manufacturing, product: "PE-150 Liquid Tape".
- E. Joint Sealant at aluminum exposed to view flashing: Low modulus single component gun-grade polyurethane sealant, non-sagging, conforming to FS TT-S-000227E, Type II, Class A, and ASTM C 920, Type S, Class 12-1/2, Grade NS, use NT, M, A and O with a minimum movement capability of ± 25 percent, equal to the following:
1. Mameco International, Inc. (Division of Tremco), product "Vulkem 116".
 2. Sika Corp., Lyndhurst NJ: product, "Sikaflex".
 3. Sonneborn Building Products Inc. (BASF), Minneapolis MN: product, "Sonolastic NP1".
 4. Tremco, Beachwood OH: product, "Dymonic".
 5. Pecora Corporation, Harleysville PA: product "Dynatrol I".
- F. Plastic cement as recommended by roofing manufacturer and eave protection manufacturer.

2.3 FLASHING FABRICATION - GENERAL

- A. Form flashings, or to profiles indicated on the Drawings, to protect materials from physical damage and shed water.

- B. Form sections square and accurate to profile, in maximum possible lengths, free from distortion or defects detrimental to appearance or performance. To the greatest extent applicable, fabricate sheet metal components in shop, and thoroughly clean all joints on both sides of the sheet metal work.
- C. Fabricate cleats and starter strips of same material as sheet.
- D. Form pieces in longest practical lengths, with flat lock seams. Hem exposed edges on underside 1/4 inch, miter and seam corners.
- E. Fabricate corners from one piece with minimum 18 inch long legs, solder for rigidity, seal with sealant.

2.4 FACTORY FINISHES

- A. Finish (all exposed aluminum flashings and brake metal): Shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
 - 1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 - 2. Basis of Design: P.P.G. Industries Inc.; product "DuramarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuramarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluoropon Classic II."
 - 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 - 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - 5. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 1.00 mil dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place and nailing strips located.
- B. Beginning of work shall constitute acceptance of the conditions of the surfaces to which this work is to be applied.

3.2 PREPARATION

- A. Field measure site conditions prior to fabrication.

- B. Install starter and edge strips, and cleats before starting installation.
- C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.
- D. Insert flashings into reglets to form tight fit. Secure in place with plastic wedges at maximum of 8 inches on center. Seal flashings into reglets with sealant.
- E. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- F. Cleat and seam all joints. Apply plastic cement compound between metal flashings and felt flashings, asphalt shingle roofing or asphalt roll roofing.
- G. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- H. Seal all aluminum joints watertight.
- I. During the installation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 FLASHING INSTALLATION - GENERAL

- A. Except as otherwise shown on the reviewed shop drawings or specified herein, the workmanship of sheet metal work, method for forming joints anchoring, cleating, provisions for thermal movement shall conform to the standard details and recommendations of the sheet metal producer and those of producer organizations and research institutions and associations concerning the sheet metal used, in addition to the standards and details set forth in the referenced materials specified this Section.
- B. Face nailing will not be permitted, concealed cleating or other concealed method must be used to attach sheet metal work to structure.
- C. Ensure that fastenings do not exceed 8 inches on centers. Use flat head fasteners throughout, and seal all fastener heads after installation thereof.
- D. Fill all slip joints and overlapping surfaces in the assembly with specified sealant material, removing all excess sealant material from the prefinished surfaces immediately, to prevent staining the finish.
- E. Install continuous vents full length of soffits, unless otherwise indicated.

3.4 CLEANING

- A. Daily clean work areas by eping and disposing of debris.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

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Section 07 72 00
ROOF ACCESSORIES
(TRADE CONTRACT AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Precast concrete paver units and pedestal system.
 - 2. Roof-top prefabricated elevator shaft vent(s)

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 30 00 - METAL DECKING: Metal roof deck.
- D. Section 07 54 19 - POLYVINYL CHLORIDE (PVC) ROOFING
 - 1. Sheet membrane flashings for flanges of curbs, and sheet membrane roofing and flashing system.
 - 2. Factory fabricated and finished roof edging.
- E. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: miscellaneous flashings.
- F. Section 09 91 00 - PAINTING: Field painting of roof accessories.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated by the Hot Dip Process
 - 2. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM E 85 - Test Method for Surface Burning Characteristics of Building Materials.
 4. UL - Fire Hazard Classifications
 5. FM - Roof Assembly Classifications.
 6. All applicable federal, state and municipal codes, laws and regulations for ratings of roof assemblies
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. NRCA - Roofing and Waterproofing Manual.
 2. SMACNA - Architectural Sheet Metal Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each roof specialty item and related accessories furnished hereunder, include data on shape of components, materials and finishes, anchor types and locations.
 2. Manufacturer's installation instructions: Indicate interface with adjacent components, and perimeter conditions.
 3. Shop drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work. Provide details bearing dimensions of actual measurements taken at the project
 - a. Dimensioned plan layout of precast concrete paver units, indicating all joints therein.
 4. Selection Samples:
 - a. Manufacturer's standard chips of integral colorant additive for precast concrete paver units, for selections by the Architect.
 5. Verification Samples:
 - a. After receipt of Architect's color selections, submit one 12 by 12 by 2-inch thick piece of precast concrete paver in each selected color, and in proposed surface texture.
 - b. One pedestal, of each specified type and size.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with NRCA details.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage time.

- C. Store all materials in an elevated dry location, protected by waterproof coverings.
- D. Distribute any pavers stored on roof levels for immediate use to prevent concentrated loads that would impose excessive strain on deck or structural members.

1.8 PROJECT CONDITIONS

- A. Perform work of this Section when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.
- B. Field Measurements: Do not delay job progress, allow for field tolerances.

1.9 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include repair or replacement of roof accessories which exhibit defects in materials or workmanship. Defects is defined as uncontrolled leakage or water and abnormal aging or deterioration.

1.10 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to 3 percent of pavers for each color, finish and type installed.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 CONCRETE PAVERS AND PEDESTALS

- A. Precast concrete pavers: Solid concrete masonry units, fabricated from normal weight aggregates conforming to ASTM C 33, Portland cement, air-entraining agents, integral water repellants, finely-ground silica, integral colorant, and other filler materials; having a compressive strength of not less than 8,000 p.s.i., a maximum water absorption of 5 percent after 24-hour submersion in cold water, and having no breakage when subject to 50 cycles of freezing and thawing, as per ASTM C67, Section 8.
 - 1. Acceptable products
 - a. Basis of Design: Wausau Tile Company, Inc., Wausau, Wi., product: "Plank Pavers."
 - b. Hanover Architectural Products, Hanover PA., product: "Prest Pavers".
 - c. Stepstone, Inc., Gardena CA., product: "Large Scale Calarc Pavers"
 - 2. Sizes (in alternating pattern, as indicated):
 - a. Nominal 12 by 24 inch by 2 inch thick.
 - b. Nominal 12 by 36 inch by 2 inch thick.
 - 3. Provide custom modification to pavers to accommodate flush mounted up-lights occurring in paver system.
- B. Deck Pedestals:

1. Manufacturer: Bison Deck Supports, Denver CO. Product: "Level.it Pedestals" or approved equal.
 - a. Pedestal: Equal to Bison Deck Supports "Level.it" Model LC with an adjustable height range between 1 3/8 inches (35 mm) and 4 1/2 inches (114mm), 5 7/8 inch (150mm) diameter by 5/16 inch (8mm) thick plate with a 27 square inch (174 sq. cm) bearing surface area.
 - b. Extender Coupling Type 1: Equal to Bison Deck Supports C4 Coupler, allowing a height increase between 2 1/2 inches (64 mm) to 4 inches (101mm) with bracing tabs.
 - c. Extender Coupling Type 2: Equal to Bison Deck Supports C1 Coupler, allowing a height increase between 1/4 inch (6mm) to 1 1/2 inches (44mm) with bracing tabs.
 - d. Spacer Tabs: Manufacturer's standard 4.5mm thick for uniform spacing.
 - e. Load Capacity: 500 lbs. (226 kg) per pedestal maximum with a safety factor of 2.
 - f. Material: Mineral filled high density copolymer polypropylene.
 - 1) Brittleness Temperature: Passes ASTM D 746.
 - 2) Softening Temperature of Plastics: Passes ASTM D 1525.
 - 3) Shore Hardness: Passes ASTM D 1706.
 2. Leveler disks:
 - a. Equal to Bison Deck Supports Model LD4: Slope 1/4 inch per foot. stackable to four units for slope compensation up to 1 inch. Center point thickness 3/8 inch (10 mm).
 - b. Equal to Bison Deck Supports Model PH5: Top mounted adjustable leveler disk used for precise top leveling with incremental adjustment from zero to 5/8 inch per foot.
 - c. Material: Same as pedestal.
 3. Shims:
 - a. Equal to Bison Deck Supports Model B11 fabricated from 1/16 inch (1.5mm) EVA.
 - b. Equal to Bison Deck Supports "Flexible Poly Shims" Model SED18 or Model SED116 fabricated from 1/8 inch (3mm) or 1/16 inch (1.5mm) flexible PVC.
 - c. Equal to Bison Deck Supports "Rigid Poly Shims" Model PS1 fabricated from mineral filled high density copolymer polypropylene
 4. Base pads:
 - a. Equal to Bison Deck Supports Model FIB: Pedestal base pad for use on roofing and waterproofing installations over insulation, with a 12 inch by 12 inch x 11/16 inches (305mm x 305mm x 17.5mm) base bearing surface.
 - b. Material: Same as pedestal.
- C. Adhesives for paver pedestals: As approved by the roofing manufacturer.

2.2 ROOF TOP ELEVATOR LOUVER

- A. Description: Factory prefabricated roof-top gravity ventilator unit, channel-type frame, welded construction throughout, having non-drainable louvers on three sides with hood.
 - 1. Acceptable Manufacturers and models: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include the following, or approved equal:
 - a. Buckley Associates, Hanover, MA., model PELV-100-38-1 (Basis of Design).
 - b. Greenheck, Schofield, WI, model PEV-400.
 - c. McDermott Metal Works Corp., Lakeville MA., model M-445-PH.
- B. Curb and corners: constructed from 0.081 inch thick, alloy 5052 sheet aluminum.
- C. Louvers:
 - 1. Minimum Free Area: 5 Square feet.
 - 2. Blades: constructed from 0.081 inch thick, alloy 6063-T5 extruded aluminum; positioned at 45 degrees; spaced at 5 inch on center.
 - 3. Screen: mechanically fastened to inside face of louver.
- D. Smoke Damper: Greenheck model VCD-23, or approved equal.
- E. Finish: factory primed, urethane enamel, Kynar 500, color as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION OF CONCRETE PAVERS ON ADJUSTABLE PEDESTALS

- A. Layout and stack Compensators as required to achieve a level terrace surface on sloping concrete deck. Maintain a stable base when stacking multiple Compensators.
- B. Fit shims to Paver Support Pedestals as required for final elevation adjustment.
- C. Use 1/2 Compensators and Paver Support Pedestals at edges, and 1/4 units at corners. Run subsequent rows of pavers parallel to the first row.
- D. Place the pavers by lowering them vertically, rather than nosing into position. Align and make leveling adjustments as the Work progresses.

3.3 INSTALLATION – ELEVATOR VENT

- A. Examination: Ensure that all receiving nailers have been completely installed and are in proper condition to receive the unit.

- B. Coordinate with installation of roofing system and related flashings for weathertight installation.
- C. Apply bituminous paint on non-factory painted surfaces of units in contact with dissimilar metals to prevent electrolytic corrosion.
- D. Perform the installation in strict accordance with the manufacturer's installation specifications. Install units plumb, level in alignment and plane without warp or rack.
- E. Anchor units securely, fill voids between ribs in steel decking with mineral fiber fireproofing.

3.4 ADJUSTING

- A. Test operation of vents and hatches upon completion of the installation. Make any and all adjustments necessary to ensure proper operation.
- B. Touch up damaged coatings and finishes.

3.5 CLEANING

- A. Remove all labels and packing materials from roof accessories, and thoroughly clean all metal surfaces free from dirt, handling marks, and other foreign matter.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 72 36
SMOKE VENTS
(TRADE CONTRACT AS PART OF SECTION 07 00 02)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 02 – ROOFING AND FLASHING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Prefabricated heat and smoke vents.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 30 00 - METAL DECKING: Metal roof deck.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood curbing, nailers and blocking.
- E. Section 07 54 19 - POLYVINYL CHLORIDE (PVC) ROOFING
 - 1. Sheet membrane flashings for flanges of curbs, and sheet membrane roofing and flashing system.
 - 2. Factory fabricated and finished roof edging.
- F. Division 26 - ELECTRICAL: Connection of vent release mechanism to building fire/smoke alarm system

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 525 - General Requirements for Steel Sheet, Zinc-Coated by the Hot Dip Process
 - 2. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.

3. ASTM E 85 - Test Method for Surface Burning Characteristics of Building Materials.
 4. UL - Fire Hazard Classifications
 5. FM - Roof Assembly Classifications.
 6. All applicable federal, state and municipal codes, laws and regulations for ratings of roof assemblies
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. NRCA - Roofing and Waterproofing Manual.
 2. SMACNA - Architectural Sheet Metal Manual.
- 1.5 SUBMITTALS
- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each roof specialty item and related accessories furnished hereunder, include data on shape of components, materials and finishes, anchor types and locations.
 2. Manufacturer's installation instructions: Indicate interface with adjacent components, and perimeter conditions.
 3. Shop drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work. Provide details bearing dimensions of actual measurements taken at the project
- 1.6 QUALITY ASSURANCE
- A. Conform to applicable code for UL and FM requirements as applicable to fire rated roof smoke vents. Refer to applicable building codes for roofing requirements and limitations. When a conflict exists, the more restrictive document will govern.
- B. Provide certificate of compliance from authority having jurisdiction indicting approval of smoke vents.
- 1.7 DELIVERY, STORAGE AND HANDLING
- A. Deliver products in unopened, factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Store under cover and protect from weather damage.
- B. Sequence deliveries to avoid delays, but minimize on-site storage time.
- C. Store all materials in an elevated dry location, protected by waterproof coverings.
- 1.8 PROJECT CONDITIONS
- A. Perform work of this Section when existing or forecasted weather conditions are within the limits established by manufacturers of the materials and products used.
- B. Field Measurements: Do not delay job progress, allow for field tolerances.

1.9 WARRANTY

- A. Provide 5 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include repair or replacement of roof accessories which exhibit defects in materials or workmanship. Defects is defined as uncontrolled leakage or water and abnormal aging or deterioration.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.2 HEAT AND SMOKE VENTS, ACOUSTICAL, UL-LISTED

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Bilco Company, New Haven, CT., model "GS-SV", complying with requirements specified below.
 - 1. Custom size: As indicated on Drawings.
 - 2. Manufacturers: Subject to compliance with the requirements specified herein, and Architect's/Engineer's approval, manufacturers offering products which may be incorporated in the work include the following:
 - a. The Bilco Company, New Haven CT.
 - b. Babcock-Davis Hatchways, Inc., Arlington MA.
 - c. Dur-Red Products, Cudahy Ca.
 - d. Nystrom Inc., Minneapolis MN.
- B. Smoke hatch characteristics:
 - 1. Material: Cover and frame are 14 gauge (1.9mm) G-90 paint bond galvanized steel.
 - 2. Clear opening dimension of 10 square feet minimum, per unit.
 - 3. Covers: Brake-formed, hollow-metal with 3 inch (76mm) concealed fiberglass insulation, 5 inch (127mm) beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf (195 kg/m²) live load
 - a. Provide with clear polycarbonate double dome.
 - 4. Curb: 12 inch (305mm) in height with integral cap flashing and 3 inch (76 mm) fiberglass insulation that is fully enclosed by a 14 gauge (1.9 mm) G-90 paint bond galvanized steel liner. Curb has fully welded corners and a 5 inch (127 mm) mounting flange with 7/16 inch holes (11mm) provided for securing to the roof deck.
 - 5. Gasket: Extruded PVC gaskets permanently adhered to the underside of the covers.
 - 6. Hinges: Heavy-duty zinc plated piano hinges with 1/4 inch (6mm) hinge pins.
 - 7. Latch: Positive hold/release mechanism controlled by the building fire alarm system with a separate latching point for each cover. Designed to hold the covers closed against a 90 psf (438 kg/m²) uplift force. Provided with interior and exterior pull release cables to manually open vent covers.

8. Operation: Corrosion resistant gas springs open covers automatically against a 10 psf (49 kg/m²) snow/wind load when released. Gas springs have built in dampers to assure a controlled rate of opening and automatically lock the covers in the full open position.
9. Finish: Manufacturer's standard powder coat finish in white color as approved by the Architect.
10. Hardware: Corrosion resistant gas springs and hot dip galvanized steel stop cables. All other hardware is zinc plated/chromate sealed

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION - SMOKE VENTS

- A. Coordinate with installation of roofing system and related flashings for weathertight installation.
- B. Perform the installation in strict accordance with the manufacturer's installation specifications. Install units plumb, level in alignment and plane without warp or rack.
- C. Anchor units securely, fill voids between ribs in steel decking with mineral fiber fireproofing.

3.3 ADJUSTING

- A. Test operation of vents and hatches upon completion of the installation. Make any and all adjustments necessary to ensure proper operation.
- B. Touch up damaged coatings and finishes.

3.4 CLEANING

- A. Remove all labels and packing materials from roof accessories, and thoroughly clean all metal surfaces free from dirt, handling marks, and other foreign matter.
 1. Do not remove UL labels and "Risk of Fall" or other similar warning labels.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

Section 07 81 00
APPLIED FIREPROOFING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of spray applied fireproofing where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install factory blended, spray applied cementitious fireproofing.
 - 1. Provide sealer at return air enclosures (plenums).
 - 2. Provide type C fireproofing at designated exterior columns.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING.
- D. Section 05 30 00 - METAL DECKING.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM E 84 - Test for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E 119 - Fire Tests of Building Construction and Materials.
 - 3. ASTM E 605 - Thickness and Density of Sprayed Fire-Resistive Material Applied to Structural Members.

4. ASTM E 736 - Cohesive Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
5. ASTM E 759 - Effect of Deflection of Sprayed Fire-Resistive Material Applied to Structural Members.
6. ASTM E 760 - Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members.
7. ASTM E 761 - Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members.
8. ASTM E 859 - Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.
9. ASTM E 937 - Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.
10. ASTM G-21 - Determining Resistance of Synthetic Polymeric Materials to Fungi.
11. UL - Fire Resistance Directory.
12. All applicable federal, state and municipal codes, laws and regulations for fire-resistant construction.

B. Definitions:

1. Structural Steel Elements: Structural building components scheduled to receive SFRM including: built-up trusses, steel decking, form decking, beams, columns, cross-braces, and related structural steel.
2. SFRM (Sprayed Fire-Resistant Materials) is spray-applied fireproofing as specified under this Section and defined under the International Building Code.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner, Architect, General Contractor, Fireproofing Applicator's Project Superintendent, Fireproofing manufacturer's technical representative and representatives of other related trades as directed by the Architect or Contractor.
2. Agenda:
 - a. Scheduling of fireproofing operations.
 - b. Review of staging and material storage locations.
 - c. Coordination of work by other trades.

- d. Installation procedures for ancillary equipment.
 - e. Protection of completed Work.
 - f. Establish weather and working temperature conditions to which Architect and Contractor must agree.
 - g. Emergency rain protection procedure.
 - h. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.
- C. Sequencing:
- 1. Sequencing for application to steel decking:
 - a. Apply spray-applied fire resistive material to steel deck which has been fabricated and erected in accordance with the criteria set forth by the Steel Deck Institute. Refer to Structural Drawings and Specifications.
 - b. The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roof is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and construction roof traffic has ceased.
 - 1) Fire protection shall not be applied to steel floor decks prior to the completion of concrete work on that deck.
 - 2) When occasional roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.
- D. Scheduling:
- 1. The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of sprayed fire protection is complete in an area.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
- 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and limitations of fireproofing.
 - 2. Test and Evaluation Reports:
 - a. Bond strength of fireproofing: ASTM E 72, tested to provide minimum bond strength twenty times weight of fireproofing materials.
 - b. Fire test reports of fireproofing application to substrate materials similar to project conditions.
 - c. Reports from reputable independent testing agencies, of product proposed for use, which indicate conformance with ASTM E 119 and ASTM E 84
 - 3. Manufacturer's Instructions and typical details: Indicate special application procedures or conditions.
 - 4. Qualifications Data: For installer and testing agency.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Certificates: Installers certificate stating that sprayed fireproofing has been completed in full accordance with requirements to provide necessary fire resistance ratings.
2. Record Documentation: Installer's Field Reports stating environmental conditions during the installation of fireproofing materials, include temperature and humidity conditions.
3. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of fireproofing.
- C. Qualifications:
 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 2. Special Inspector of Sprayed Fire-Resistant Materials, Mastic and Intumescent Fire Resistant Coatings: A qualified person retained by the General Contractor and approved by the Owner, as having the competence necessary to inspect the work of this Section 07 81 00.
 - a. The Special Inspector shall be an independent third party hired directly by the General Contractor.
 - b. The Special Inspector shall have a valid and current ICC Spray-Applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector 1 Certificate with not less than 1 year related experience.
 - c. An Associate Special Inspector, shall be an engineer-in-training with related experience.

1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 29 – MOCK-UPS.
- B. Construct mockup as follows, conform to project requirements for fire ratings, thickness and density of application.
 1. Apply a mock-up area consisting of a typical overhead fireproofing installation, including not less than 15 feet (4.5 m) of beam and deck.
 2. Apply second mock-up consisting of a typical column.
- C. Locate where directed by Architect. Schedule mock-up installation with Owner's Project Representative for observation.
- D. Examine installation within one hour of application to determine variance due to shrinkage, temperature and humidity.

1. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary then remove materials and reconstruct mockup.
- E. Accepted mockup may remain as part of the work.
1. Keep accepted mock-up installation open for observation as criteria for sprayed-on fireproofing work.
- 1.9 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials, factory proportioned and mixed, in original, unopened packages bearing the name of the product, manufacturer's name, plant identification, lot number and Underwriter's Laboratories, Inc. label.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Store all materials in an elevated dry location, protected by waterproof coverings.
 3. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage.
- 1.10 SITE CONDITIONS
- A. Do not apply spray fireproofing when ambient temperature or surface temperature of substrate material is below 40 degrees Fahrenheit.
- B. Provide ventilation in areas to receive fireproofing during and 24 hours after application, to cure fireproofing material.
- 1.11 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Special Warranty: Provide 2 year warranty or bond which shall include failure of fireproofing, including: cracking, checking, dusting, flaking, spalling, separation and blistering. Failure to provide such performance will require re-installation to repair to satisfaction of Owner at no additional cost.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Carboline, Fireproofing Products, St. Louis MO. ("Carboline")
 2. GCP Applied Industries, Cambridge, MA. ("GCP")
 3. Isolatek International, Inc. "CAFECO", Stanhope NJ.
 4. Southwest Fireproofing Products Co. (*Division of Carboline*), Albuquerque, NM ("Southwest").

2.3 DESCRIPTION

- A. General: Spray applied fireproofing, factory proportioned and mixed meeting the following requirements:
1. Sprayed fireproofing materials (SFRM) shall be free of all forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite. Material manufacturer shall provide certification of such upon request.
 2. Fireproofing materials shall not be subject to losses from finished application by sifting, flaking or dusting.
 3. Fireproofing shall not deform more than 10 percent under 500 pound per square foot compressive forces in accordance with ASTM E 761.
 4. Bare, shop-coated, and galvanized steel sheets with the fireproofing applied shall be kept at 90 degrees Fahrenheit and 70 percent relative humidity for 240 hours without evidence of corrosion of steel, tested in accordance with ASTM E 937.
 5. Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.
 6. Combustibility: Fireproofing material shall have a maximum total heat release of 20 MJ/m² and a maximum 125 kw/m²² peak rate of heat release 600 seconds after insertion when tested in accordance with ASTM E1354 at a radiant heat flux of 75 kw/m² with the use of electric spark ignition. The sample shall be tested in the horizontal orientation.
 7. Surface Burning Characteristics: When tested in accordance with ASTM E84, the material shall exhibit the following surface burning characteristics:
 - a. Flame Spread 10
 - b. Smoke Developed 0
- B. Regulatory Requirements:
1. Provide under Section 01 45 29 - TESTING LABORATORY SERVICES: Certification by an independent testing laboratory acceptable to the Owner, that materials, dry densities, thickness, and application procedures satisfy the requirements

of the governing laws, building code, and UL requirements, with respect to the minimum protection requirements specified herein when tested in accordance with ASTM E 119.

2.4 PERFORMANCE/DESIGN CRITERIA

- A. Materials, procedures for application, dry densities, and thicknesses necessary to provide the required protection shall be tested and rated by UL in accordance with the procedures of UL 263 (ASTM E119) for the uses indicated
- B. The UL listing for each fire rated assembly must state that the superimposed load used in the test was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL listings with a Load Restriction are not allowed.
- C. Fire ratings interpolated or extrapolated from actual test data will not be acceptable. Provide evidence prior to application that proposed materials, installation methods and materials have been approved by all authorities having jurisdiction.
- D. Thickness and density: Thickness and dry density of fire protection material shall be according to the manufacturer's data and UL requirements to provide the following fire resistance ratings at rated central core .
 - 1. Steel columns: 1 hour fire resistance rating.
 - 2. Primary steel members, including: trusses, girders, and beams: 1 hour fire resistance rating.
 - 3. Secondary steel members, including: girts, and purlins: 1 hour fire resistance rating.
 - 4. Steel roof deck: 1 hour fire resistance rating.

2.5 MATERIALS

- A. Spray applied fireproofing Type A – “Light Density”: For structural steel elements including: built-up trusses, steel deck, beams, and columns, and all other concealed applications except as otherwise indicated on the drawings, or as otherwise specified herein:
 - 1. Acceptable products:
 - a. Carbolite, product: “Pyrolite 15HY”.
 - b. GCP, product: “Monokote Type MK-6”.
 - c. Isolatek International, product: “Cafco 300”.
 - d. Southwest, product: “5GP”.
 - 2. Performance Criteria:

Property	Test Method	Test value/results
Compressive Strength	ASTM E 761	3.5 lb/in ² , minimum
Bond Strength	ASTM E 736	200 lb/ft ² , minimum
Air Erosion	ASTM E 859	3.5 grams/ft ² , maximum
Deflection	ASTM E 759	No evidence of cracking or delamination

-
- | | | | |
|--|-------------|------------|---|
| | Bond Impact | ASTM E 760 | No evidence of cracking or delamination |
| | Dry Density | ASTM E 605 | 14 lb/ft, minimum |
3. Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical center load resulting in a downward deflection of 1/120th of the span.
 4. Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.
 5. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have a minimum bond strength of 150 psf (pounds per square foot) [667N].
 6. Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft.
 7. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 750 psf (pounds per square foot).
 8. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL design, or as required by the Authority having jurisdiction, or shall have a minimum average density of 15 pcf (pounds per cubic foot).
 9. Resistance to Mold: Formulate the fireproofing material at the time of manufacturing with a mold inhibitor.
 - a. Test fireproofing material per ASTM G-21 and show resistance to mold growth for a period of 21 days for general use and 60 days for materials installed in plenums.
 - 1) Tested fireproofing material shall demonstrate resistance to mold growth when inoculated with aspergillus niger.
 10. The material shall have been tested and reported by Underwriters Laboratories, Inc. (UL) in accordance with the procedures of UL 263 (ASTM E119).
- B. Spray applied fireproofing Type B – “Medium Density”: Steel columns, steel framing and steel decking exposed within elevator shafts, and at all non-concealed (exposed to view) conditions:
1. Acceptable products:
 - a. Carboline, product: “Pyrolite 22”.
 - b. GCP, product: “Monokote Type Z-106”.
 - c. Isolatak International, product: “Cafco 400”.
 - d. Southwest, product: “7GP”.
 2. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/UC design or as required by the authority having jurisdiction, or shall have a minimum average of 22 pcf (pounds per cubic foot).

3. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have a minimum bond strength of 430 psf (pounds per square foot) [1913N].
 4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (pounds per square foot).
- C. Spray applied fireproofing Type C – “High Density”: For structural steel elements adjacent to louvers, exterior screens, and where exposed to weather.
1. Acceptable products:
 - a. Southwest, product: “7HD”.
 - b. Carboline, product: “Pyrocrete 40”.
 - c. GCP, product: “Monokote Type Z-146”.
 - d. Isolatek International, product: “Fendolite M-II”.
 2. Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL/ULC design or as required by the Authority having jurisdiction, or shall have a minimum average of 39 pcf.
 3. Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 1,000 psf (pounds per square foot) [4448N]
 4. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 43,200 psf (pounds per square foot).
- D. Potable water shall be used for the application of sprayed fireproofing materials.
- E. Adhesive:
1. Bonding adhesive for fibrous materials as recommended and supplied by the fireproofing material manufacturer. Adhesive may be an integral part of the material or applied separately to surface receiving fireproofing material.
- F. Sealer:
1. Carboline, product: “Carboguard 1390”.
 2. GCP, product: “Firebond Concentrate”.
 3. Isolatek International, product: “Bond-Seal”.
 4. Southwest, product as recommended by manufacturer.
- G. Mold Inhibitor: Mold inhibitor shall be added to fireproofing materials in accordance with manufacturer’s instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Inspect all surfaces and verify that they are in proper acceptance of existing substrate and site conditions.
 - a. Contact fireproofing manufacturer for procedures on handling primed / painted steel.
 - b. Ensure clips, hangers, supports, sleeves and other attachments to the substrate are placed by others prior to the application of spray-applied fire resistive materials.
2. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Close and seal ductwork in areas where fireproofing is being applied.
- B. Provide temporary enclosures to prevent spray from contaminating air.
- C. Protection of In-situ Conditions: Protect adjacent surfaces and equipment from damage by overspray and dusting. Mask adjacent work as required. Clean, or repair all existing materials which are soiled or otherwise damaged by Work of this Section, to match original profiles and finishes. Existing materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work to match existing.
- D. Surface Preparation:
 1. Clean substrate of dirt, dust, grease, oil, loose material, or other matter which may effect bond of fireproofing.
 2. Remove incompatible materials which affect bond by scraping, brushing, scrubbing, or sandblasting. Repair or replace any work so damaged and soiled.

3.3 MIXING AND APPLICATION

- A. Mixing shall conform to manufacturer's written instructions.
- B. Materials and equipment shall be as approved by the materials manufacturer. Application shall be by licensed manufacturer's applicators. Procedures shall be in strict accordance with said manufacturer's directions and specifications. Only experienced, skilled mechanics approved by the materials manufacturer shall be allowed to place the materials. A qualified manufacturers representative shall be present for initial application to guide and assist applicator's personnel.
- C. Work shall comply with applicable UL standards in addition to the requirements imposed by the applicable laws and codes, for the indicated ratings, including local pollution control regulations.
- D. Sprayed-on fireproofing shall be applied in the exact manner described in the certificates submitted to prove compliance with specified protection requirements. The fireproofing applicator shall be responsible for providing a controlled application of fireproofing material so that uniform quantity and thickness is maintained.
- E. After completion of fireproofing work, equipment shall be removed and all surrounding wall and floor areas cleaned of deposits of sprayed-on fireproofing

materials. Where hangers and other surfaces not requiring fireproofing have been sprayed unavoidably, the sprayed material shall be removed and the surfaces made clean.

3.4 REPAIR

- A. Patch all areas of testing and any area where fireproofing has been damaged or removed during construction.

3.5 FIELD QUALITY CONTROL

- A. Independent Testing Agency field inspection (Special Inspections will be performed under the provisions of Section 01 45 29 - TESTING LABORATORY SERVICES.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
 - 1. Prior to fireproofing application, verify surface preparation is in accordance with the written instructions of the approved manufacturer.
 - 2. Verify substrate temperature before and after application is in accordance with the written instructions of the approved manufacturer.
 - 3. Verify ventilation of area before and after application is in accordance with the written instructions of the approved manufacturer.
 - 4. Measure average thickness per ASTM E605 and International Building Code, Chapter 17.
 - 5. Determine density in accordance with ASTM E605 and International Building Code, Chapter 17.
 - 6. Determine cohesive/adhesive bond strength in accordance with ASTM E736 and International Building Code, Chapter 1.
 - a. Test bond strength to primed steel, painted steel and unpainted steel, as appropriate to project.
 - 7. Test for bond impact strength: ASTM E-760.
- C. Ensure that applied fireproofing remains exposed to view until verification inspections and testing is made and approval of applied fireproofing is obtain. All costs for removal and replacement of prematurely installed materials to allow inspection of fireproofing shall be borne by the Contractor.
- D. Fireproofing will be considered defective if it does not pass tests and inspections.
 - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
 - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- E. Inspection and testing shall verify that applied thickness and density meets manufacturer's tested requirement standards for required fire-resistance ratings.
 - 1. Where samples fail to meet thickness, quality, or dry density requirements, further sampling and testing will be required in the area of deficient sample. If

such further testing indicates a deficient area, correction shall be made by the application of additional material or removal and replacement of faulty material.

3.6 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris. Place waste material in suitable bags or containers, and remove from site.
- B. Upon completion of the work of this Section in any given area, clean walls, floors (including bare concrete slabs) and surrounding surfaces of overspray and drippings. Remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Waste Management:
 - 1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

Section 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install fireproof firestopping, firesafing materials, smoke seals and related accessories required for this Project for all penetrations through fire resistance rated construction, including, but not limited to, penetrations for elevators, plumbing, fire suppression, heating, ventilating and air conditioning, electrical systems, and specialized equipment.
 - 1. Fire resistance rated construction requiring firestopping includes, but is not limited to: floors, rated partitions, smoke barriers, smoke partitions, partitions in rated corridors, passageways and stairs, shaft partitions, shaft wall (vertical and horizontal), area separation fire walls, party wall systems, and temporary fire resistant rated partitions and barriers.
 - 2. Provide removable temporary firestopping (pillows) as required to maintain fire integrity prior to Owner's final acceptance, to permit installation of electrical, telephone, data and sound system wiring. Replace temporary firestopping with permanent, after wiring systems are completed.
- B. Furnish and install firestopping/smoke seals at construction joints occurring at tops of fire resistance rated partitions, smoke partitions, and temporary partitions between top of partition and underside of deck above.
- C. Furnish and install all firestopping, firesafing, and smoke seals at perimeter of floor/roof construction and exterior wall systems, as indicated and where required by applicable codes.
- D. Furnish and install all firestopping, firesafing, and smoke seals at expansion joints in chase walls where expansion joints are not exposed to view.
- E. Furnish and install all firestopping, firesafing, and smoke seals where required by applicable codes and as additionally required by authorities having jurisdiction at no additional cost to the Owner.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.

- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY: Masonry partitions.
- D. Section 05 31 00 - STEEL DECKING: Metal floor and roof deck.
- E. Section 07 81 00 - APPLIED FIREPROOFING: Spray applied fireproofing.
- F. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard fireproofing.
- G. Division 21 - FIRE SUPPRESSION: Fire protection system penetrations through fire resistance rated construction.
- H. Division 22 - PLUMBING: Plumbing system penetrations through fire resistance rated construction.
- I. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Heating, ventilating and air conditioning system penetrations through fire resistance rated construction.
- J. Division 26 - ELECTRICAL: Electrical penetrations through fire resistance rated construction.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E119 - Method for Fire Tests of Building Construction and Materials.
 - 3. ASTM E814 - Test Method of Fire Tests of Through-Penetration Firestops.
 - 4. ASTM E2174 - Standard Practice for On-site Inspection of Installed Fire Stops
 - 5. ASTM E2393 - Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
 - 6. NFPA 70 - National Electrical Code.
 - 7. UL - Fire Resistance Directory.
 - 8. UL 1479 - Fire Tests of Through Penetration Firestops.

1.5 PERFORMANCE REQUIREMENTS

- A. Provide materials and work to conform to Building Code Requirements in fire resistant wall and floor assemblies.
- B. Manufacturer's certified product test requirements:

1. All firestop/smokeseal material shall be tested by a recognized, independent testing agency and shall conform to both Flame (F-rating) and Temperature (T-rating) requirements of ASTM E-814.
 2. Conform to UL Fire Hazard Classification Requirements.
 3. Tested and classified non-combustible per ASTM E-84.
- C. Firestops in place shall be of sufficient thickness, width, and density to provide a fire resistance rating at least equal to the floor, wall, or partition construction into which it is installed.
- D. Non-combustible dams shall be constructed:
1. As necessary to achieve fire rating as tested and rated.
 2. In conformance with installation requirements for type of floor, wall, and partition construction.
 3. As recommended by firestop/smokeseal manufacturer.
- E. Combustible damming materials, if used, must be removed after proper curing.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, and physical properties.
 - a. Indicate requirements for manufacturer's descriptive data for products and related materials with FM, UL or Warnock-Hersey illustrations showing systems and approval of materials in systems.
 2. Certificates: Manufacturer's written certification stating that firestopping materials, meet or exceed the requirements specified under this Section and that all fire-resistive requirements for the indicated combustibility, Flame (F-rating) and Temperature (T-rating) Ratings have been met.
 3. Manufacturer's installation instructions.
 4. Test reports: Submit fire test reports from recognized, independent testing agent(s) indicating the following:
 - a. Fire test report of firestop material applied to substrate and penetration materials similar to project conditions. Tests to indicate both Flame (F-rating) and Temperature (T-rating) Ratings.
 - b. Test reports of products to be used shall indicate conformance to ASTM E-814.
 5. On-site sample installation to be included in Work: Minimum thirty days prior to application in any area, provide samples of firestop and smoke seal materials and installation in accordance with the following requirements.
 - a. Apply one sample of appropriate firestop and smoke seal material for each different penetration and fire rating required for the work.
 - b. Sample areas will comply with thickness, fire resistance ratings, and finished appearance of the project and applicable fire code.
 - c. Acceptance samples will constitute standard of acceptance for method of application, thickness, and finished appearance for firestop and

smokeseal application. The sample(s) shall remain visible during completion of the work and shall remain as part of the completed work.

6. Shop drawings indicating requirements for penetrations in wall/deck intersections, change of planes, control joints, expansion joints and blank openings.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain firestop and smoke seal products from a single manufacturer, except as otherwise approved by Architect.
- C. Environmental Requirements for Volatile Chemicals: Use firestopping caulks that comply with the following limits for VOC content:
 1. Firestopping caulks: VOC not more than 250 g/L.
- D. Special Inspections: Allow for 3 percent of each type of firestopping system to be removed and inspected for conformance with approved submittals.
 1. firestopping shall be inspected prior to installation of suspended ceilings or concealed by other materials.
- E. Qualifications:
 1. Installer: a specialized subcontractor having not less than 3 years documented experience demonstrating previously successful work of the type specified herein.
 - a. The manufacturer of the firestop material shall submit written certification that the firm to be used for the firestop products has been trained in the application of the products by the manufacturer.
 2. Independent Third Party Firestopping Inspector: a specialized testing agency having not less than 5 years documented experience demonstrating previously successful work of the type specified herein.

1.8 MOCK-UPS

- A. Provide mock-ups under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying quality of firestop installation.
- B. Provide firestop samples and locate as directed. Accepted samples may remain as part of the work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store firestopping materials in original, sealed, packages showing manufacturer's identification and date of packaging.
- B. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following, or approved equal:
1. Bio Fireshield (A Division of Rectroseal), Houston TX.
 2. Dow Corning Corporation, Midland MI.
 3. Hilti, Inc. Tulsa OK.
 4. 3M Company, Saint Paul MN.
 5. Specified Technologies, Inc., Somerville NJ.
 6. Metacaulk, (A Division of Rectroseal), Houston TX.
 7. Tremco, Inc., Beachwood OH.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.3 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire resistance ratings and surface burning characteristics.
- B. Obtain certificate of compliance from authority having jurisdiction indicating approval of combustibility.

2.4 MATERIALS

- A. Firestop mortar: asbestos free, cementitious mortar, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM/UL1479.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Novasit K-10".
 - b. Hilti, Inc., product "CP 637 Firestop Mortar".
 - c. Specified Technologies, Inc., product "SSM Firestop Mortar".
 - d. Tremco Inc., product "Tremstop M".
- B. Firestop sealant: Single component, non-combustible firestop sealant, U.L. classified as a "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product product "Biotherm 100" (Gun Grade) or "Biotherm 200" (Self Leveling).
 - b. Hilti, Inc., product "CFS-S SIL GG" (Gun Grade).
 - c. Specified Technologies, Inc., product "SpecSeal SIL300 Sealant (gun grade)" or "SpecSeal SIL300SL" (Self Leveling).

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- d. 3M Company, product "Fire Barrier Silicone Sealants".
 - e. Tremco Inc., product product "Tremsil" (Gun Grade) or "Tremsil S/L" (Self Leveling).
2. Sealants will not dissolve in water.
- C. Intumescent firestop sealant and caulks: Acrylic based, water resistant sealant, which will not re-emulsify after drying.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Biostop 500".
 - b. Hilti, Inc., product "FS-ONE Intumescent Firestop Sealant" or "FS 657 Fireblock".
 - c. Specified Technologies, Inc., product "SpecSeal SSS".
 - d. 3M Company, product "Fire Barrier Caulk CP25WB+".
 - e. Tremco Inc., product "Tremstop 1A".
- D. Firestop putty: sticks or pads.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Moldable Putty".
 - b. Hilti, Inc., product "CP 767 Speed Strips" or "CP 777 Speed Plugs".
 - c. Specified Technologies, Inc., product "SpecSeal Putty Bars and Pads".
 - d. 3M Company, product "Fire Barrier Moldable Putty".
 - e. Tremco Inc., product "Flowable Putty".
- E. Firestop collars: Pre-manufactured fire protective pipe sleeve, UL classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
1. Provide separated (two piece) firestop collar for application when plastic pipe system is already in place. Provide non-separated firestop collar for application prior to installation of plastic pipe system.
 2. Acceptable products, or approved equal:
 - a. Bio Fireshield, product, product "Fireshield Pass-through Device", or "Biostop Intumescent Sleeve."
 - b. Hilti, Inc., product "CP 643 Firestop Collar".
 - c. Specified Technologies, Inc., product "SpecSeal Collars".
 - d. 3M Company, product "Fire Barrier PPD's".
 - e. Tremco Inc., product "Fyrecan sleeve".
- F. Firestop pillows: UL Classified as "fill, void, or cavity material" for through penetration firestop system when tested in accordance with ASTM E-814/UL1479.
1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "Fireshield Firestop Pillows".
 - b. Specified Technologies, Inc., product "SSB Firestop Pillows".
 - c. Tremco Inc., product "Tremstop P.S".
- G. Wrap strips:

1. Acceptable products, or approved equal:
 - a. Bio Fireshield, product "FS-195".
 - b. Hilti, Inc., product "CP 645-E Endless Wrap Strip, or CP 648-S Firestop Wrap Strip".
 - c. Specified Technologies, Inc., product "Spec Seal Wrap Strip".
 - d. 3M Company, product "Fire Barrier FS195 Wrap Strip".
 - e. Tremco Inc., product "Tremco W.S".

- H. Mineral wool fiber / ceramic wool non-combustible insulation (fire safing):
Conforming to ASTM C665, Type 1, ASTM C612, and ASTM C553 with a minimum density of 4 pounds per cubic foot.
 1. Flame Spread Classification: Material shall be classified non-combustible per ASTM E-814.
 2. Recycled content of slag:: Use maximum available percentage of material (slag). Mineral wool insulation products incorporated into the work shall contain not less than 75 percent of recycled material (slag) by weight.
 3. Acceptable products include:
 - a. Fibrex Insulations Inc. Sarnia Ontario, Canada, product: "Fibrex FBX" Industrial board.
 - b. Rock Wool Manufacturing Company, Leeds, AL, product: "Delta Safing Mineral Wool".
 - c. Roxul, Inc., product "Roxul Safe".
 - d. Thermafiber, Inc. product "Safing 4.0 pcf".
 4. Accessories: Provide galvanized steel safing clips as required for installation of insulation.

- I. Elastomeric Firestopping: Non halogenated latex based elastomeric coating applied by airless spray.
 1. Acceptable products, or approved equal:
 - a. Bio Fireshield (A Division of Rectroseal), product "Biostop 750."
 - b. Hilti, Inc., product "CP 601S." or "CFS-SP-WB"
 - c. Specified Technologies, Inc., product "Spec Seal Elastomeric Firestop Spray".

2.5 ACCESSORIES

- A. Forming and damming materials: Mineral fiberboard or other type as recommended by firestopping manufacturer.
- B. Primer, sealant and solvents: As recommended by manufacturer.
- C. Woven wire mesh: Galvanized 20 gage woven wire mesh "chicken wire" or "poultry fencing", 1 inch spacing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Surface to receive firestops shall be free of dirt, dust, grease, oil, form release agents, or other matter that would impair the bond of the firestop material to the substrate or penetrating item(s).
- B. Voids and cracks in substrate shall be filled and unnecessary projection removed prior to installation of firestops.
- C. All penetrating items shall be permanently installed prior to firestop installation.
- D. Substrate shall be frost, free and, when applicable, dry.

3.3 INSTALLATION

- A. General
 - 1. Installation of firestops shall be performed by applicators/installers qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
 - 2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations. Meet building code requirements.
 - 3. Coordinate with plumbing, mechanical, electrical, and other trades to assure that all pipe, conduit, cable, and other items which penetrate fire rated construction have been permanently installed prior to installation of firestops. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestops.
 - a. Ensure that all firestopping is inspected prior to installation of suspended ceilings or concealed by other finished materials.
- B. Dam construction
 - 1. Install dams when required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Combustible damming material must be removed after appropriate curing. Incombustible damming material may be left as a permanent component of the firestop system.
 - 2. Placement of dams shall not interfere with function or adversely affect the appearance of adjacent construction.
- C. Installation of single component silicone firestop

1. Apply with manual or powered caulking gun.
 2. Apply minimum 1/2 inch thickness for 2 hour rating. Apply 1/2 inch to both sides of wall penetrations; one side only in floor penetrations.
 3. Use incombustible insulation as required to achieve fire resistance rating.
 4. Surface of gun grade silicone firestop may be tooled using clean, potable water.
 5. Clean excess material off of adjacent surfaces and tools within 10 minutes using either water or Xylol where the use of such would not be hazardous.
- D. Installation of cementitious firestop mortar.
1. Add dry powder to water and mix with mechanical mixer or hand mixing tools as recommended by firestop mortar manufacturer. Allow a average mixing time is 3 minutes and provide a average wet density of 70 pounds per cubic foot, plus or minus 5 PCF.
 2. Do not apply if ambient or substrate temperature is less than 35 degrees Fahrenheit during 24 hours after application.
 3. Wet all surfaces prior to application of firestop mortar.
 4. Mortar may be hand applied or pumped into the opening.
 5. Exposed surfaces shall be finished using conventional plastering tools prior to curing.
 6. When installation around layered cables, it is recommended to increase the fluidity of the firestop mortar to provide a better fill around the cables. Vibrate or move the cables slightly to prevent voids from forming between the cables.
 7. Allow 48 hours for initial cure prior to form removal. For full cure allow 27 days.
 8. Wet material may be cleaned with water. Dry material may require scraping or chipping.
- E. Installation of firestop collars (plastic pipe only)
1. Firestop collars may be surface mounted to a slab or wall or imbedded in Firestop Mortar to a maximum depth of 2 inches.
 2. For wall penetrations with ABS pipe firestop collars must be installed on both sides of the penetration to provide a 2 hour F and T Rating. All other applications required installation on one side only to provide a 2 hour F and T Rating.
- F. Firesafing insulation: Install firestopping safing insulation on safing clips spaced as needed between each stud and floor slab, leaving no voids. Secure safing clips to slab using fasteners recommended by insulation manufacturer. Install sealant over mineral wool in accordance with test requirements.

3.4 LABELING

- A. Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems.

1. Include the following information on labels

**WARNING: THROUGH-PENETRATION FIRESTOP SYSTEM-DO NOT DISTURB.
NOTIFY FACILITY MANAGER OF ANY DAMAGE.**

- Contractor's name, address, and phone number.
- Through-penetration firestop systems designation of applicable testing and inspecting agency.
- Date of installation.
- Through-penetration firestop systems manufacturer's name.
- Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems and to prepare test reports.
 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.
- B. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.
- C. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.6 SCHEDULE

- A. General: Typical penetrations are indicated below with list of standard firestopping/smokeseal approaches. Actual firestopping materials and combination of materials will vary with size of penetration and with individual firestopping manufacturer's approved UL Design System Requirements. Use only UL Design System materials for each penetration that best matches the wall and floor construction.
 1. Where penetrations occur for which no listed UL or WH Design System test exists, obtain from the firestop system manufacturer an engineered system acceptable to the authorities having jurisdiction for firestopping such penetrations. Engineered system from manufacturer shall include a detail drawing showing the engineered system and shall contain no disclaimers.
- B. Single metal pipe (non-insulated) and conduit penetrations through floors:
 1. Firestop mortar.
 2. Silicone Firestop sealant.
 3. Intumescent firestop sealant.
 4. Firestop putty, sticks or pads.
 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- C. Single metal pipe (non-insulated) and conduit penetrations through walls:
 1. (masonry and concrete walls only) Firestop mortar and putty.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).

3. Intumescent firestop sealant with wrap strips.
- D. Multiple metal pipe and conduit penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- E. Multiple metal pipe and conduit penetrations through walls:
1. Firestop mortar and putty.
 2. (through masonry walls only) Firestop pillows with woven wire mesh.
 3. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- F. Insulated metal pipe penetrations through floors:
1. Firestop mortar and wrap strips.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone Firestop sealant over wrap strip.
 5. Mineral fiber / ceramic wool non-combustible insulation (fire safing) in conjunction with a firestop sealant.
- G. Insulated metal pipe penetrations (single and multiple) through walls:
1. Firestop mortar with wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and Wrap strips.
 4. (multiple penetrations through masonry walls only) Firestop pillows with woven wire mesh.
- H. Duct penetrations through floors or walls:
1. Rectangular and square ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing), and steel flanges provided under Division 15.
 2. Round ducts: Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- I. Combustible plastic pipe and conduit penetrations through floors:
1. Firestop mortar with wrap strips.
 2. Firestop mortar with firestop putty and firestop collars.
 3. Silicone firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 4. Silicone firestop sealant and firestop collars.
 5. Intumescent firestop sealant and firestop collars.

6. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with firestop collars.
 7. (maximum pipe size 2 inches) Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) with wrap strips.
- J. Combustible plastic pipe and conduit penetrations through walls:
1. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant with firestop collars.
- K. Cable penetrations through floors:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- L. Cable penetrations through walls:
1. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 3. (single penetrations only) Firestop putty.
 4. (electrical boxes) Firestop pads.
 5. Firestop putty over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- M. Bus ducts through floors:
1. Firestop mortar and wrap strips.
 2. Intumescent firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing) and 28 gage (minimum) steel cover plate.
- N. Blank openings:
1. Firestop mortar.
 2. Silicone Firestop sealant over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- O. Fire rated joints:
1. Silicone Firestop sealant over backer rod or bond breaker.
- P. Floor to curtain wall assemblies:
1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
- Q. Construction joints at head of wall/floor assemblies:
1. Silicone Firestop sealant/mastic over mineral fiber / ceramic wool non-combustible insulation (fire safing).
 2. Elastomeric spray over mineral fiber / ceramic wool non-combustible insulation (fire safing).

- R. Smoke barrier sealant for dampers, fire door frames:
 - 1. Silicone Firestop sealant.

- S. Temporary sealing of openings and penetrations:
 - 1. Firestop putty, sticks or pads.
 - 2. Firestop pillows.

End of Section

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Section 07 92 00
JOINT SEALANTS
(TRADE CONTRACT REQUIRED AS PART OF 07 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 07 00 01 – WATERPROOFING, DAMPPROOFING AND CAULKING TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. General:
 - 1. This Section specifies general requirements, definition of joint sealer types, and application requirements for sealant work specified within other individual specification sections.
- B. Prepare sealant substrate surfaces.
- C. Furnish and install sealant and backing materials.
- D. Furnish and install expanding foam sealant.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY.
- D. Section 06 10 00 - ROUGH CARPENTRY.
- E. Section 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING: Sealant used in conjunction with the application of single ply membrane roofing
- F. Section 07 61 00 - SHEET METAL ROOFING: Sealant used in conjunction with sheet metal roofing system.
- G. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Sealant integral with flashing.
- H. Section 07 84 00 - FIRESTOPPING: Firestopping sealants and related backing materials.

- I. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: Perimeter sealant at exterior of storefront framing.
- J. Section 08 80 00 - GLAZING: Sealant used in conjunction with setting glass.
- K. Section 09 29 00 - GYPSUM BOARD: Application of concealed acoustical sealant used in conjunction with gypsum board work at abutting surfaces (perimeter of partitions and walls).
- L. Section 09 30 00 - TILING.
- M. Section 09 91 00 - PAINTING: Caulks used in preparation of applied finish coatings.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 717 - Standard Terminology of Building Seals and Sealants.
 - 2. ASTM C 790 – Guide for Use of Latex Sealants
 - 3. ASTM C 804 - Use of Solvent-Release Type Sealants.
 - 4. ASTM C 834 - Latex Sealing Compounds.
 - 5. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 6. ASTM C 920 - Elastomeric Joint Sealants.
 - 7. ASTM C 962 - Use of Elastomeric Joint Sealants.
 - 8. ASTM C 1193 - Guide for Use of Joint Sealants.
 - 9. ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber.
 - 10. ASTM D 3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
- B. The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. SWRI – Sealant and Caulking Guide Specification.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, chemical and physical properties and installation instructions for each item furnished hereunder.
 - 2. Selection Samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - 3. Verification Samples: 12 inch long samples of sealant for verification of color, installed where directed by Architect.
 - 4. Certificates: Manufacturer's certification that the Products supplied meet or exceed specified requirements.

5. Test and Evaluation Reports:
 - a. Compatibility and adhesion test reports: Test reports from sealant manufacturer indicating that sealant proposed for use have been tested for compatibility and adhesion with actual samples of substrates to be used on this project. Include sealant manufacturer's interpretation of test results, and recommendations for primers and substrate preparation specific to this Project.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Bonds and Warranty Documentation: Manufacturer's standard Warranties and Guarantees.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Provide sealants from a single manufacturer for all work of this Section to the greatest extent possible. Each individual type of sealant installed in the Work shall be from a single manufacturer.
- C. Qualifications:
 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
 2. Testing Agencies: To qualify for acceptance, an independent testing laboratory must demonstrate to Architect's satisfaction that it has the experience and capability to conduct satisfactory testing indicated without delaying progress of the Work.
- D. Preconstruction Compatibility and Adhesion Testing: Submit samples of all materials that will contact or affect joint sealers to joint sealer manufacturers for compatibility and adhesion testing, as indicated below:
 1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates.
 - a. Perform tests under normal environmental conditions that will exist during actual installation.
 2. Contractor shall submit for testing, and sealant manufacturer shall test at least 9 pieces of each type of material, including joint substrates, shims, and joint backer rods.
 3. Schedule testing so that it does not delay the work.
 4. Investigate materials failing these tests and obtain joint sealer manufacturer's written recommendations for corrective measures, including use of specially formulated primers.
 5. The Architect may waive part or all of these specific testing requirements if the sealant manufacturer is able to provide written certification, demonstration to the Architect's satisfaction, that sealant and substrates are compatible and that sealant performance and adhesion will not be compromised by project conditions.

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- E. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within 24-month period preceding date of Contractor's submittal of test results to Architect.
1. Test elastomeric sealant for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.
 2. Include test results performed on joint sealers after they have cured 1 year.
- F. Preconstruction Field Testing: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:
1. Locate test joints where indicated or, if not indicated, as directed by Architect.
 2. Conduct field test for each type of elastomeric sealant and joint substrate indicated.
 3. Arrange for tests to take place with both Architect and joint sealer manufacturer's technical representative present.
 4. Test Method: Test joint sealers by hand pull method described below:
 - a. Install joint sealant in 5-foot joint lengths using same materials and methods for joint preparation and joint sealant installation required for completed Work. Allow sealant to cure fully before testing.
 - b. Make knife cuts as follows: A horizontal cut from one side of joint to the other followed by 2 vertical cuts approximately 2 inches long at side of joint and meeting horizontal cut at top of 2 inch cuts. Place a mark 1 in. from top of 2 inch piece.
 - c. Use fingers to grasp 2 inch piece of sealant above 1 in. mark; pull firmly down at 90 degree angle or more while holding a straightedge along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
 5. Evaluation of field test results:
 - a. For sealant evidencing adhesive failure, determine if primer is required. If so, re-test using primer.
 - b. Sealant not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory.
 - c. Do not use sealant which fails to adhere to joint substrates during testing.
 6. Submit report to Architect with description of test, results, and recommended installation procedures to obtain proper adhesion.
 - a. Report whether or not sealant in joint connected to pull-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Each container and package must bear an unbroken seal, test number and label of the manufacturer upon delivery to the site. Failure to comply with these requirements shall be sufficient cause for rejection of the material in question, by the Architect and his requiring its removal from the site. New material conforming to said requirements, shall be promptly furnished at no additional cost to the Contract.

1.8 SITE CONDITIONS

- A. Do not install single component solvent curing sealant in enclosed building spaces.
- B. Environmental Requirements: Maintain temperature and humidity recommended by the sealant manufacturer during and 24 hours after installation. Do not proceed with installation of joint sealers under the following conditions:
 - 1. When ambient and substrate temperature conditions are below 40 degrees F.
 - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- C. Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from substrates.

1.9 WARRANTY

- A. General: Submit manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer's warranties shall guarantee sealants installed are free of manufacturing defects and conforms to the published physical properties and referenced standards effective at time of installation.
 - 1. Sealant performance: Manufacturer's warranties shall include coverage for the following listed failures, when sealants are applied in accordance with manufacturer's written instructions. Warranty to include coverage for:
 - a. Sealant will not become brittle, tear or crack due to normal exposure or normal expansion or contraction.
 - 2. Warranty period:
 - a. Silicone sealants on vertical surfaces: 20 years.
 - b. Urethane sealants on vertical surfaces: 5 years.
 - c. Urethane sealants on horizontal surfaces: 5 years.
- C. Installer's warranty: Provide 3 year warranty or bond which shall include coverage of installed sealant and accessories which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
 - 1. Installer's warrant shall include coverage for sealant that fails cohesively or adhesively.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturers and Products: To establish a standard of quality, design and function desired, Drawings and specifications have been based on the products specified under this section for each individual sealant type, for the applications scheduled at the end of Section, and as may be additionally identified on the Drawings.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. BASF Construction Chemicals (Sonneborn), Shakopee MN.
 - 2. Bostik, Inc., Wauwatosa, WI.
 - 3. Chem Link Inc., Schoolcraft, MI.
 - 4. Dow Corning Corporation, Auburn MI.
 - 5. Emseal Joint Systems Ltd., Westborough MA.
 - 6. GE Construction Sealants, Huntersville, NC.
 - 7. Momentive Performance Materials (GE Silicones), Waterford NY.
 - 8. Owens Corning, Toledo, OH.
 - 9. Pecora Corporation, Harleysville PA.
 - 10. Phenomenal Brands, Baltimore, MD.
 - 11. Schul International Company, Inc. (Sealtite), Pelham, NH.
 - 12. Sika Corp, Lyndhurst NJ.
 - 13. Specified Technologies, Inc. (STI), Somerville NJ..
 - 14. STS Coatings, Inc., Comfort TX.
 - 15. Tremco, Inc., Beachwood OH.
 - 16. Williams Products Inc., Troy MI.
 - 17. York Manufacturing, Inc., Sanford ME.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 SEALANT MATERIALS

- A. Joint Sealer Type AA (Acrylic acoustical): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable.
 - 1. Owens Corning, product: "QuietZone Acoustical Sealant."
 - 2. Pecora, product "AC-20 FTR".
 - 3. Specified Technologies, Inc. (STI), product "Smoke 'N' Sound Acoustical Sealant". (spray applied).
 - 4. Tremco, product "Tremco Acoustical Sealant".

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- B. Joint Sealer Type AP (Acrylic painters caulk): One component acrylic latex caulking compound, conforming to ASTM C 834 Type P, Grade NF, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
1. BASF (Sonneborn), product, "Sonolac".
 2. Tremco, product, "Tremflex 834".
 3. Bostik, product, "Chem-Calk 600".
 4. Pecora, product "AC-20+".
- C. Joint Sealer Type BPM (Bitumen modified polyurethane, Multi-component): Pouring grade self-leveling bitumen modified two component urethane sealant, conforming to ASTM C920, Type M, Grade P, Class 25 and FS SS-S-00227E, Type 1, Class A, with a minimum movement capability of $+50/-25$ percent, equal to one of the following:
1. BASF (Sonneborn), product "Sonomeric 2".
 2. Pecora, product "Urexpan NR-300".
 3. Tremco, product "Vulkem THC 900/901".
 4. Sika, product "Sikaflex 2CNS".
- D. Joint Sealer Type FSB (Expanding Foam type secondary backer sealant): Low modulus secondary expanding foam sealant fabricated from stabilized acrylic impregnated expanding foam sealant and cross-linked ethylene vinyl acetate (EVA) closed cell foam equal to Emseal, product "Backerseal".
- E. Joint Sealer Type FCJ (Expanding Foam-Colored Joint): Low modulus silicone faced and impregnated expanding foam sealant equal to Emseal, product "ColorSeal" having the following properties:
1. Performance Properties:
 - a. Movement capability of $+50$ percent, -50 percent, (100 percent) of nominal material size.
 - b. Shore A hardness per ASTM D 2240: 15 pts.
 - c. Staining per ASTM C 510: None.
 - d. Xenon arch weathermeter for 2000 hours per ASTM G26-77: No visible deterioration or performance change.
 - e. Surface weathering for 6000 hours per ASTM G26-77: Minimal hardness change.
 2. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion.
 3. Seal combines a factory-applied, low-modulus silicone with a backing of acrylic-impregnated expanding foam.
 - a. For inside and outside corner transitions use factory-manufactured universal 90 degree single leg units containing a minimum 12 inch long leg and a 6 inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with published installation instructions.
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- F. Joint Sealer Type HLM (Horizontal-self-Leveling, Multi-component): Pouring grade self-leveling multi-component urethane sealant, conforming to ASTM C 920, with a minimum movement capability of ± 25 percent, equal to the following:
1. BASF (Sonneborn), product, "Sonolastic SL 2" (self-leveling grade).
 2. Sika, product, "Sikaflex 2CSL".
 3. Tremco, product, "THC-900 / THC-901".
- G. Joint Sealer Type P50 (Polyurethane 1-component): Very low modulus single component gun-grade polyurethane sealant or silyl-terminated polyurethane, non-sagging, conforming to ASTM C 920, Type S, Class 50, Grade NS, use M, A and O with a minimum movement capability of ± 50 percent, equal to the following:
1. BASF (Sonneborn), product "MasterSeal NP100".
 2. Sika, product "Sikaflex 15LM".
 3. Tremco, product "Dymonic 100".
- H. Joint Sealer Type PE (Polyether): Low modulus type, Single-component non-sagging gun-grade, low-odor, neutral curing polyether, sealant, conforming to ASTM C 920, Type S, Class 25, Grade NS, use NT, T, M, G, A and O with a minimum movement capability of ± 25 percent, equal to the following:
1. BASF (Sonneborn), product, "Sonolastic 150".
 2. STS Coatings, product "GreatSeal PE-150" Sealant.
 3. Chem Link, product "MetaLink".
 4. York Manufacturing, product: "LT-100 Polyether Sealant".
 5. Tremco, product "Dymonic FC".
- I. Joint Sealer Type SC (Silicone, general construction): One-part medium modulus, natural cure, synthetic sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, NS, Class 50, use NT, G, A, M, O with a minimum movement capability of ± 50 percent, equal to the following:
1. Dow Corning, product, "791".
 2. GE Silicones, product, "Silpruf".
 3. Pecora, product, "895".
 4. Sika, product, "Sika Sil-C 995".
 5. Tremco, product, "Spectrem 2".
- J. Joint Sealer Type SE (Silicone, Exterior construction): Ultra-low modulus, moisture or neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 100/50, with a minimum movement capability of +100 percent and -50 percent, equal to the following:
1. Dow Corning, product, "790".
 2. GE Silicones, product, "SCS2700 SilPruf LM".
 3. Sika, product "Sikasil-WS-290".
 4. Tremco, product "Spectrem 1".
- K. Joint Sealer Type SM (Silicone, Mildew-resistant): USDA approved one component acetoxysilicone rubber, mildew resistant, acceptable to local health officials,

conforming to U.S. Food and Drug Administration regulation 21 CFR 177.2600, and ASTM C 920, Type S, Class 25, Grade NS, use NT,G and A with a minimum movement capability of ± 25 percent, and a Shore A hardness of 20, equal to the following:

1. BASF (Sonneborn), product "OmniPlus".
2. Dow Corning, product "786".
3. GE Silicones, product "Sanitary 1700".
4. Tremco, product "Tremsil 200 Sanitary".
5. Pecora, product "898NST".

2.4 ACCESSORIES

- A. Compressible joint bead back-up: Compressible closed cell polyethylene, extruded polyolefin or polyurethane foam rod complying with ASTM C 1330, Type C, 1/3 greater in diameter than width of joint. Shape and size of compressible back-up shall be as recommended by manufacturer for the specific condition used. Provide one of the following, or equal.
1. Construction Foam Products (Division of Nomaco, Inc.), Zebulon, NC, product "HBR Closed Cell".
 2. Industrial Thermo Polymers Ltd., Brampton, Ontario CN, product "ITP Standard Backer Rod".
 3. BASF Construction Chemicals (Sonneborn), Shakopee MN, product "Sonolastic Closed Cell Backer Rod".
 4. W.R. Meadows Inc., Hampshire, IL, product "Sealtight Kool-Rod".
- B. Primers: Furnish and install joint primers of the types, and to the extent, recommended by the respective sealant manufacturers for the specific joint materials and joint function.
- C. Bond-breaker tape, and temporary masking tape: Of types as recommended by the manufacturer of the specific sealant and caulking material used at each application, and completely free from contaminants which would adversely affect the sealant and caulking materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General:
1. Weather conditions must be dry and of the temperature, as recommended by sealant manufacturer, during application operations.

2. Surface receiving work of this section must be absolutely dry and dust free. All joints receiving sealant/caulking materials and primers shall be subject to the approval of the sealant manufacturer for proper use of specified materials.
- B. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 1. Clean ferrous metals of all rust and coatings by wire brush, grinding or sandblasting. Remove oil, grease and protective coatings with cleaners recommended by sealant manufacturer.
- C. Prime joint substrates, as recommended in writing by joint-sealant manufacturer, as based on preconstruction joint-sealant-substrate tests or as based upon prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- D. Verify that joint backing and release tapes are compatible with sealant.
- E. Perform preparation in accordance with ASTM C 804 and C 790 for solvent and latex base solvents, respectively.

3.3 INSTALLATION

- A. General: Conform to SWRI requirements, and sealant manufacturer's written requirements for installation.
- B. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 1. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 2. Do not stretch back-up material into joints.
- C. Install bond breaker in joints where shown in the Drawings and wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
- D. Apply masking tape or other precautions to prevent migration or spillage of materials onto adjoining surfaces.
- E. Apply urethane sealants, silicone sealants, and latex caulking materials into joints in accordance with manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.
 1. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 2. Maintain the outer edge of the sealant and caulking materials, where side faces of joints are in the same plane, back 1/8-inch from the faces.

3. Apply sealant in continuous beads without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
 4. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
 5. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.
- F. Take care not to block-off weep tubes or any through wall opening constructed to allow weeping of accumulated water.
- G. Apply pouring self-leveling urethane sealant (Sealant designation **HLM**) into horizontal joints in accordance with manufacturer's instructions, to a level approximately 1/16 inch below adjacent surfaces.
1. Apply sealant without open joints, voids or air pockets so as to provide a watertight and airtight seal for the entire joint length.
 2. After placement of the sealant and caulking materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
 3. Remove the temporary masking tape immediately after tooling, and before the sealant has taken initial set.

3.4 INSTALLATION PRE-FORMED FOAM SEALANTS

- A. General: The joint configuration and the joint surfaces shall be as detailed in the Drawings and in accordance with the current material Tech Data available from the Manufacturer. Field measurements of the depth and width of the joint shall be supplied to manufacturer before material is ordered.
- B. Joint sealer/expansion joint material to be installed in strict accordance with the manufacturer's instructions.
1. Installed each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material.
 2. Install in manner to provide seal continuity at ends, turns and intersections of joints.
 3. Provide additional wet seal joints where required by manufacturer.
- C. Remove all strip-off waste materials and excess foam sealant from site immediately upon completion of work.

3.5 CLEANING

- A. Clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealant and caulking materials with solvents which will not damage the surfaces in any way.

3.6 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.7 SCHEDULE

- A. General: Seal joints indicated and all interior and exterior joints, seams, and intersections between dissimilar materials.
- B. Sealant Colors:
 - 1. Colors for Sealant Types "HLM" "P50", "SC", "SE", and "SM": As selected by the Architect from manufacturer's standard colors.
 - 2. Color for Sealant Types "AA" and "AP": White.
 - 3. Color for Sealant Type "PE": Black.
 - 4. In concealed installation, and in partially or fully exposed installation where so approved by the Architect, standard gray or black sealant may be used.
- C. Specialty Joint Conditions:
 - 1. Sealing termination bars and through-wall flashing in cavity walls: Sealant type: PE.
- D. Exterior joints (Listed by primary building material abutting sealant joints):

1. Concrete :

Joint Condition	Sealant Type
a. Concrete to concrete, vertical control joints:	SE
b. Concrete to concrete vertical expansion joints greater than 2 inch width:	FCJ
c. Concrete foundation walls to abutting concrete, and other non-bituminous pavements, steps, platforms, and ends of ramp, (horizontal joints):	HLM
d. Concrete slabs on grade to abutting non-bituminous pavements (horizontal joints, including pedestrian traffic surfaces):	HLM
e. Concrete to concrete saw cut and tooled control and isolation joints in horizontal surfaces including pedestrian traffic surfaces:	HLM
f. Concrete to concrete control, expansion and isolation joints in horizontal vehicular traffic surfaces:	BPM
g. Concrete and non-bituminous sloped (5% to 12%) pavement ramps (horizontal joint) at abutting concrete or masonry foundation walls:	HT
h. Concrete to all items which penetrate exterior concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	P50

2. Exterior Masonry:

Joint Condition	Sealant Type
a. Masonry to masonry, expansion and control joints, 1 inch and less:	SE
a. Masonry to masonry, expansion and control joints greater than 1 inch:	FSB+SX

- b. Masonry to masonry, expansion joints greater than 2 inch width: FCJ
- c. Masonry to abutting masonry, or concrete: SE
- d. Masonry to abutting non-porous materials (painted metals, anodized aluminum, mill finished aluminum, PVC, glass, and similar materials): SE
- e. Masonry to all items which penetrate exterior masonry walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items: SE

3. Exterior Metal:

Joint Condition	Sealant Type
a. Metal to metal:	SE
b. Metal to glass:	SE

E. Interior joints (Listed by primary building material abutting sealant joints):

1. Interior Concrete:

Joint Condition	Sealant Type
a. Concrete to concrete (including precast), vertical joints:	SC
b. Concrete to concrete: horizontal walkable surfaces:	HLM
c. Concrete to concrete horizontal vehicular traffic surfaces (including forklift):	BPM
d. Concrete and non-bituminous pavement ramps (5 to 12 Percent) horizontal joints at abutting vertical concrete or masonry surfaces:	HT
e. Concrete to all items which penetrate concrete walls, including, but not necessarily limited to, door frames, louver frames, pipes, vents, and similar items:	SC
f. Precast concrete to abutting materials (vertical joints):	SC

2. Interior Masonry:

* Includes interior side of exterior masonry walls.

Joint Condition	Sealant Type
a. Masonry to masonry control joints*:	P50
b. Masonry* to Gypsum board:	SC
c. Masonry to all items which penetrate masonry walls, including, but not necessarily limited to, window frames, door frames, louver frames, and similar items:	SC
d. Masonry to all pipes, conduit and vents which penetrate non-rated masonry walls*:	SC

3. Gypsum Board:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Gypsum board to metal or wood trim:	AP
b. Gypsum board to abutting surfaces at exposed tops and bottoms partitions and walls:	AA
c. Gypsum board to masonry:	SC
d. At gaps and spaces between gypsum board to interior door and window frames, penetrating conduits and piping, building specialty items, ductwork, and similar items:	AP
e. Gypsum board to plumbing fixtures:	SM

4. Architectural millwork and casework:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Casework to abutting materials, kitchens, toilet rooms and similar "wet spaces":	SM
b. Casework to abutting surfaces (except in "wet" spaces):	AP
c. Countertops to abutting wall surfaces and to abutting casework:	SM
d. Countertops to plumbing fixtures and fittings:	SM

5. Interior metal:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Metal to metal:	SC

6. Interior floor drains:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Floor drains to concrete slab:	SE
b. Floor drains to resilient sheet flooring:	SE

7. Acoustical ceilings:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Acoustical ceiling edge angle to irregular wall surface	AP

8. Tile:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Tile to tile vertical, and horizontal non-traffic joints:	SM
b. Tile to tile, horizontal pedestrian traffic joints:	HLM

9. Sanitary plastic wall and ceiling panels to abutting surfaces

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Sanitary plastic panels to abutting materials:	SM
b. Sanitary plastic panels to abutting materials:	SF

10. Interior Wood:

<u>Joint Condition</u>	<u>Sealant Type</u>
a. Wood to wood (natural or stained finishes)	SC

- | | | |
|----|--|----------|
| b. | Wood to wood (painted opaque finishes) | AP or SC |
| c. | Wood to metal | SC |
| d. | Wood base to wall surfaces | SC |

End of Section

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Section 08 00 05
METAL WINDOWS TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section is work of a Publicly Bid Trade Contractor and includes the following requirements:
1. Specification requirements for Trade Contract "METAL WINDOWS" include all of the following listed Specification Sections: in their entirety:
 - a. Section 08 00 05 - METAL WINDOWS Trade Contract REQUIREMENTS.
 - b. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS
 - c. Section 08 63 00 - METAL-FRAMED SKYLIGHTS.
- B. Submit bid as directed by and in compliance with the Request for Bids, the Instructions to Bidders, and this Article 1.2.
- C. Submit bid on the bid form provided in the Project Manual.
- D. Submit bid in a sealed envelope in the manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- E. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Trade Contract, unless specifically called out otherwise, regardless of where among the Drawings it appears:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A104, A200, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, A230, A300, A301, A311, A312, A313, A314, A315, A316, A317, A318, A319, A320, A321, A322, A513, A520, A521, A522, A523, A524, A530, A531, A532, A570, A605, A222, A470, A490, A802, A221, A540, A541, A002, A453, A463, A503, A510, A511, A512, A514, A515, A533, A401, A402, A403, A404, A405, A406, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A426, A427, A429, A623, A400.
 2. The complete List of Drawings for the Project is provided on the cover sheet of Drawings.
- F. Refer to Section 01 23 00 - Alternates, for Bid alternates which may affect the scope of Work of this Section.

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- G. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
 - 1. None Required.
 - H. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(G), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of MGL c. 149, §§ 44A-J.
 - I. The BIDDING REQUIREMENTS, CONTRACT FORMS, and Contract Conditions as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.4 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.5 QUALITY ASSURANCE

- A. Company specializing in work described in the above listed individual specification Sections with minimum 5 years documented experience.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to

satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.

- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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Section 08 05 13

COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes general requirements for preparation, installation and temporary protection, for door frames, doors and door hardware provided under the General Construction Contract. Work additionally includes:
 - 1. Fitting and preparation of hardware for unfinished wood doors.
 - 2. Installation of lock cylinders into special doors.
- B. Install door frames, hang doors, and install finish hardware, which are furnished under the following designated Sections:
 - 1. Section 08 11 13 - Hollow Metal Doors and Frames
 - 2. Section 08 14 16 - Flush Wood Doors
 - 3. Section 08 33 23 - Overhead Coiling Doors
 - 4. Section 08 43 13 - Aluminum-Framed Storefronts
 - 5. Section 08 71 00 - Door Hardware
 - 6. Section 08 88 14 - Fire-Rated Glazing and Framing Systems

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Setting and temporary bracing of hollow metal frames occurring in masonry, and removal of temporary centering when frames have been built into the masonry.
- D. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES
- E. Section 08 14 16 - FLUSH WOOD DOORS
- F. Section 08 33 23 - OVERHEAD COILING DOORS
- G. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS
- H. Section 08 71 00 - DOOR HARDWARE
- I. Section 08 80 00 – GLAZING: Installation of field-installed glazing, with final installation of loosely-attached glazing stops.

1.3 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 2. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors or Steel Frames View Scope
 3. ANSI/BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames
 4. ANSI/SDI A250.8 – Recommended Specifications for Standard Steel Doors and Frames.
 5. ANSI/SDI A250.11 – Recommended Erection Instructions for steel frames.
 6. All applicable federal, state and municipal codes, laws and regulations for exits.
 7. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
 8. NFPA publication 80 - Fire Doors and Windows.
 9. WDMA Industry Standard IS 1A-13.
 10. UBC 43.2 – Fire Tests of Door Assemblies.
 11. UL 10B - Fire Tests of Door Assemblies.
 12. UL 10C – Positive Pressure Fire Door Test Method.
 13. Warnock-Hersey - Certification Listings for fire doors.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.5 SUBMITTALS

- A. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

1. Tools: Tools for maintenance: All special tools packaged with hardware items shall be saved, tagged/identified as to product use, and turned over to the Owner upon completion of the Work.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.

1.7 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
 - a. Tag or label packages with door opening number(s) coordinated with door and hardware schedule.
 3. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
 4. Store wood doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.
- C. Storage and Handling Requirements:
 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- D. Packaging Waste Management: Comply with disposal and recycling requirements specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- E. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 SITE CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is

operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period

PART 2 - PRODUCTS

2.1 ACCESSORIES

- A. Fasteners: Use fasteners furnished with hardware for installation.
 - 1. Where fasteners are not furnished with item, use fasteners of suitable size and type to harmonize with item as to material and finish and to suit material to which fastened.
 - 2. Use machine screws and metal expansion shields to secure hardware to concrete, ceramic or quarry tile, or solid masonry. Do not use fiber, plastic, and lead plugs or adhesives.
 - 3. Use non-ferrous metal fastenings exposed to weather.
 - a. Brass/Bronze finish hardware: Bronze fasteners, matching finish of hardware.
 - b. Aluminum, stainless steel and painted steel hardware: Type 302/304 stainless steel fasteners.
 - c. Chrome finish hardware: Chrome plated brass/bronze fasteners.
- B. Hinge Shims:
 - 1. Interior door shims:
 - a. Typical hinges: steel shims in thickness for conditions required.
 - b. Stainless steel hinges: Stainless steel, type 302 or 304, thickness for conditions required.
 - c. Brass/bronze hinges with brass/bronze frames: Architectural bronze sheet in thickness for conditions required.
 - 2. Exterior door frame shims:
 - a. All hinge materials: Stainless steel, type 302 or 304, thickness for conditions required.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive doors and frames.
 - 1. Verify that opening sizes and tolerances are acceptable and in compliance with these specifications and applicable codes.
 - 2. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all in situ surfaces which are soiled or otherwise damaged by Work of this Section, to match

indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

3.3 GENERAL ERECTION/INSTALLATION FRAMES AND DOORS

- A. General: Install frames and doors in accordance with the manufacturer's recommendations, ANSI/SDI-100, ANSI A250.8, SDI-105, NFPA-80 and the Door Hardware Institute recommendations. Install with a maximum diagonal distortion of 1/16 inch measured with a straight edge, corner to corner.
- B. Installation of fire-resistance rated and smoke rated doors:
 - 1. Install fire rated doors in accordance with NFPA 80.
 - 2. Do not remove qualified testing and inspection agency label.
- C. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

3.4 ERECTION/INSTALLATION METAL DOOR FRAMES

- A. Steel Place in-position all steel frames, in accordance with the approved shop drawings and frame schedule.
 - 1. During the installation of metal door frames, after the manufacturer's steel shipping bars have been removed, install wood spreaders at door opening, carefully dimensioned to permit square and plumb installation of door frames and doors.
 - a. Provide rigid temporary bracing for frames as required to ensure maintenance of positioning, and remove only after frames have been permanently anchored.
 - b. For doors located in masonry work, maintain frame position with temporary bracing until frames are built-into-place, and grout has sufficiently cured to maintain frame position.
 - c. Spreaders shall remain in place until doors are installed.
 - 2. Coordinate installation of frames with the various trades installing abutting wall construction for anchor placement.
 - a. Secure frames with the following number of anchors per jamb.
 - 1) For frames 7'-6" in height or less: 3 anchors per jamb.
 - 2) For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
 - 3) For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
 - 4) For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
 - 5) For frames over 10'-0' in height: 5 anchors per jamb.
 - 3. Secure frames, occurring in existing masonry, with expansion bolts and sleeves.
 - 4. Where exposed fastener heads occur in frames, fill with automotive body filler and sand smooth.

3.5 GENERAL INSTALLATION DOORS AND HARDWARE

- A. General: Install doors and door hardware in accordance with manufacturer's instructions and requirements of referenced organizations, and the requirements of Section 08 71 00 - DOOR HARDWARE.
 - 1. Center doors in the opening or frame with contact surfaces fit tight and even without forcing or warping the components.
 - 2. Do not hang wood doors in areas where materials are not sufficiently dry so as to not affect the dimensional stability of the door.
 - 3. Replace doors and frames that do not conform to hardware height requirements.
- B. Hang doors and install hardware when concrete work, plastering, tile setting, and other operations have been completed which increase humidity and dust in building.
- C. Install hardware (except hinges) after field painting of doors and frames, or field sealing of doors has been completed.
- D. Drill and tap screw holes in steel frames and doors for surface mounted hardware.
- E. Install hardware at the location (heights) indicated on Drawings, or as otherwise required by regulatory requirements.
- F. Carefully fit and securely attach hardware items to doors and frames.
- G. Closers including those with hold-open features:
 - 1. Where closers are mounted on doors, mount with hex nuts and bolts; fasten foot to frame with machine.
 - 2. Mount to provide maximum door opening permitted by building construction or equipment.
 - 3. Use regular arm mounting except where door swing is less than 90 degrees or closer is on interior of exterior door or door is equipped with roller latch.
- H. Thresholds:
 - 1. Install thresholds in a bed of sealant with machine screws and expansion shields.
 - 2. Cut thresholds to closely fit jambs.
 - 3. Drill and cut for door holders and bottom bolts where required.
- I. Rain Drips: Install rain drips for heads of door frames not protected by canopy or soffit.
- J. Weatherstripping and seals:
 - 1. Accurately cut and fit weatherstrips and seals. Carefully aligned for full contact and tight seal and secure firmly to maintain weatherproof, waterproof, and lightproof seal without preventing smooth and easy operation of doors.
 - 2. Provide suitable blocking where necessary to clear hardware; and make adjustments as required to meet special conditions encountered.

3. Prime paint wood surfaces which have been cut with wood sealer before weatherstrips are installed.
4. Light seals: Install seals on door frames for lightproof doors. Secure seals to door frames at jamb and heads with contact adhesive to prevent infiltration of light.
5. Sound control devices: Install sound rated door gasketing and bottom seal, and adjust to obtain the specified sound rating.
6. Automatic Door Bottoms: Install automatic door bottom so that gasket is automatically forced down to tightly seal instantly when the door is fully closed, and raised instantly when the door begins to open. Mount automatic door bottom to provide 5 mm (3/16 inch) clearance at door bottom.

3.6 FIELD FITTING AND INSTALLATION OF WOOD DOORS

- A. Do not alter pre-fit and pre-finished doors.
- B. Field-fitted doors:
 1. Unless otherwise detailed, fit hinged doors with 3 mm (1/8 inch) clearance at hinge stiles, 3 mm (1/8 inch) at top and lock or meeting stiles, and 19 mm (3/4 inch) between bottom rail and floor.
 2. Bevel lock edge and meeting stile of single acting wood doors 3 mm (1/8 inch) for each 50 mm (2 inches) of door thickness.
 3. Immediately after fitting and cutting of wood doors for hardware, seal edges of doors as specified in Section 09900, PAINTING.
 4. Mortise wood doors for hardware using templates furnished under Section 08 71 00 – DOOR HARDWARE.
 5. Cut sinkages for lock fronts, strikes, hinges and similar items same size as item installed.

3.7 ADJUSTING

- A. Adjust Doors, including hardware to operate as designed without binding or deformation of the members.
- B. After installation, clean surfaces, remove temporary labels, paint spots and other defacement.
- C. Clean prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the manufacturer.
- D. Prior to Final Inspection make final check and adjustment of all hardware, clean operating items as necessary to restore proper function and finish of hardware.

3.8 TOUCH-UP FINISHES

- A. Field touch-up of doors, scheduled for opaque finishes, will be performed under Section 09 91 00 - PAINTING and includes the filling and touch-up of exposed job made nail or screw holes, refinish of raw surfaces resulting from fitting or job inflicted scratches and marks.

- B. Field touch-up of doors, scheduled for transparent finishes, will be performed by an authorized representative of the door fabricator. Touch-up includes refinishing surfaces resulting from fitting, or job inflicted scratches and marks.

3.9 CLEANING

- A. General: Clean work under provisions of Section 01 73 00 - EXECUTION.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment, packing materials, and all rubbish and debris from the work area; leave area in broom-clean condition.
 - 1. Daily clean work areas by sweeping and disposing of debris.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.10 PROTECTION

- A. Protect doors and hardware from damage until completion of the project. Comply with provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of hollow metal doors and frames where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Provide the following products:
 - 1. Flush UL-Labeled and non-labeled steel doors, complete with internal reinforcing, hardware cut-outs; and provided with glazing openings, where so indicated; installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
 - 2. Hollow metal frames for doors and fixed-glazed lites, UL-Labeled and non-labeled, complete with internal reinforcing; installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
 - 3. Glazing beads, loosely attached to hollow metal frames and doors, where so indicated, for removal and permanent installation during glazing operations; installed by: Section 08 80 00 - GLAZING.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY: Building-into masonry hollow metal door frames, placed and braced under Section 06 10 00 - Rough Carpentry.
- D. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking, and nailers.
 - 2. Placement and temporary bracing of hollow metal frames built-into masonry.
- E. Section 06 20 00 - FINISH CARPENTRY: Wood casing and trim.

- F. Section 07 92 00 - JOINT SEALANTS.
- G. Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION: Installation of doors and frames.
- H. Section 08 14 16 - FLUSH WOOD DOORS: Furnishing wood doors to be installed in hollow metal frames.
- I. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs and reinforcing.
- J. Section 08 80 00 - GLAZING: Furnishing and installing glass located in doors and frames.
- K. Section 09 29 00 - GYPSUM BOARD: Gypsum grout fill for hollow metal frames occurring in gypsum drywall assemblies.
- L. Section 09 91 00 - PAINTING: Applied finish coatings.
- M. Division 26 – ELECTRICAL: Wiring connections for electrified door hardware.
- N. Building-in of frame anchors to wall and partition construction: By trade responsible for wall and partition erection.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcing.
 3. ANSI/SDI A250.8 – R2008 (formerly SDI 100) - Recommended Specifications for Standard Steel Doors and Frames.
 4. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
 5. ASTM A109 / A109M - Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled.
 6. ASTM A568 / A568M - Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
 7. ASTM A653 / A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 8. ASTM A924 / A924M - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 9. ASTM A1008 / A1008M - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

10. ASTM A1011 / A1011M - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
11. ASTM C1363 - Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus.
12. SDI 111 Series (111A-111F): Recommended Details, Steel Doors and Frames.
13. SDI 117-93: Manufacturing Tolerances for Standard Steel Doors and Frames.
14. NFPA publication 80 - Fire Doors and Windows.
15. NFPA publication 105 – Standard for the Installation of Smoke Door Assemblies.
16. UL publication 10B - Fire Tests of Door Assemblies.
17. UL publication 10C – Positive Pressure Fire Tests of Door Assemblies.
18. UL 1784 – Air Leakage Tests of Door Assemblies.
19. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
2. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing doors and frames.
3. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
4. Do not fabricate doors or frames before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and accepted by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, for doors, frames and shop applied finishes.
2. Shop Drawings:
 - a. Door and Frame Schedule: A complete schedule coordinated with, and using same identifier designations as, the door and frame schedule contained in the Contract Drawings.
 - b. Large scale details of each type door and frame construction, indicating all gages, reinforcing, and anchorage.
 - 1) Indicated cutouts for glazing.

- 2) Indicate cutouts for louvers.
 3. Certificates: Manufacturer's written certification stating that doors, frames, and all related items to be furnished hereunder, meet or exceed the requirements specified under this Section; that specified galvanized and shop priming has been performed; and that all U.L. fire-resistive requirements for the indicated Labels have been met.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Bonds and Warranty Documentation: Manufacturer's standard warranty.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards, specified materials, and methods of construction.
 - B. Sole Source: Obtain doors and frames specified in this Section from a single manufacturer.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
 1. Prior to shipping, identify each frame and door with a removable metal or plastic label which corresponds with door schedule identifying opening number and location.
 2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 3. Deliver doors and frames boxed or crated to provide protection during transit and job storage.
 4. Inspect doors and frames upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
 - B. Storage and Handling Requirements:
 1. Store and handle materials following manufacturer's recommended procedures.
 2. Store doors and frames at the building site upright and under cover. Place the units on wood dunnage and cover in a manner that will prevent rust and damage.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Amweld Building Products, Inc., (A Division of Amweld International, LLC), Coppell TX.
 2. Ceco Door Products (A Division of Assa Abloy Group Company), Milan TN.
 3. Curries Company (A Division of Assa Abloy Group Company), Mason City IA.
 4. Republic Doors and Frames, McKenzie TN.
 5. Steelcraft (A Division of Allegion Company), Cincinnati OH.

2.3 DESCRIPTION

- A. Regulatory Requirements:
1. Fire resistance rated door construction shall conform to UL publications 10B and 10C.
 - a. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 2. Fire resistance rated borrowed light assemblies: NFPA 80.
 3. Corridor door assemblies shall be tested and listed per UL 1784.
 4. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors
 5. Install fire rated door assemblies in compliance with NFPA 80.
- B. Sustainability Requirements:
1. Recycled content of Ferrous Metals: Use maximum available percentage of recycled steel. Steel incorporated into the work shall contain not less than 25 percent of recycled steel.

2.4 PERFORMANCE CRITERIA

- A. Exterior Openings: Comply ASTM C1363 for minimum thermal ratings. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
 - a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.29, R-Value 3.4, including insulated door, thermal-break frame and threshold.
 - 1) Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.

2. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
 - a. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

2.5 DOORS

- A. General: Refer to the Drawings for design of doors, sizes, glazing cut-outs in doors, and details.
- B. Construction: Full flush commercial type, 1-3/4 inches thick, unless noted otherwise, meeting or exceeding the materials, gages, construction, and testing requirements of the referenced ANSI and SDI publications.
 1. Exterior Door Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5 inches on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Exterior Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 2. Interior Door Core Construction: Manufacturer's standard polystyrene core, or polyurethane core (at non-rated doors only).
 - a. Interior Fire Door Core: Mineral board core, as required to provide fire-protection and temperature-rise ratings indicated.
- C. Interior Doors 1-3/4 inch thick (44.4 mm): ANSI 250.8, Level 2, Model 1 (Full Flush), ANSI A250.4 Physical Performance Level B, (Heavy Duty) having 18-gage, minimum 0.042 inch (1.0 mm) steel faces, with a minimum STC rating of 32.
 1. Fire-rated doors: Modify specified construction to meet all construction requirements required for fire-resistive rating.
 - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated door, indicating applicable rating.
- D. Exterior Doors: ANSI 250.8, Level 3, Model 2 (Seamless), ANSI A250.4 Physical Performance Level B, (Extra Heavy Duty) having 16-gage, 0.058 inch thick (1.46 mm) A60 galvanized steel faces, with a minimum core R-value of 6.25.
 1. Visible edge seams: weld edge seams and finish for seamless appearance (Model 2).
- E. Removable Glazing stops: Rectangular channel sections, not less than 20-gage, 0.032 inch thick (0.8 mm) steel; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.

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- F. Hardware reinforcing: Welded in place steel reinforcement, hot rolled pickled and oiled steel per ASTM A569. Provide G-60, hot-dipped galvanized reinforcing for all exterior openings, and locations where galvanized doors and frames are scheduled. Reinforcing shall be not less than the following minimum steel thicknesses:
1. Hinges: 7 gage, minimum 0.167 inch (4.2 mm) thick.
 2. Closers: Box/channel-shape reinforcing, 12 gage, minimum 0.093 inch (2.3 mm) thick.
 3. Locks: Box/channel-shape reinforcing,
 - a. Cylindrical locks: 16 gage, minimum 0.053 inch (1.3 mm) thick.
 - b. Mortise locks: 14 gage, minimum 0.067 inch (1.6 mm) thick.
 4. Kick plates: 18 gage, minimum 0.042 inch (1.0 mm) thick.
 5. All other hardware: 14 gage, minimum 0.067 inch (1.6 mm) thick.
 6. Locations for reinforcing shall be determined from information and templates provided under Section 08 71 00 - DOOR HARDWARE.
- G. Provide UL approved welded steel astragal at each UL pair of fire doors.
- H. Fabrication
1. Fabricate exposed faces of door panels from cold-rolled steel only.
 2. Fabricate concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at manufacturer's option).
 3. Fabricate doors with hardware reinforcement welded in place.
 4. Attach fire rated label to each door unit.
 5. Close top and bottom edge of exterior doors with flush end closure. Seal joints watertight.

2.6 HOLLOW METAL FRAMES

- A. General: Refer to the Drawings for various types of frames, sizes, and profiles, UL fire-resistive Label frames, and other characteristics of frames and related items.
1. Frame type (all frames): Shop welded frames with mitered joints arc-welded, reinforced and ground smooth.
- B. Materials for frames, reinforcement, anchors, anchor clips and related items: commercial grade cold-rolled steel conforming to ASTM A109 or commercial grade hot-rolled and pickled steel conforming to ASTM A415.
1. Frame gage:
 - a. Interior frames: 16-gage, 0.053 inch thick (1.3 mm), except as otherwise required for specific U.L. Label.
 - b. Exterior frames: 14-gage, 0.067 inch thick (1.7 mm), with an A60 zinc coating (galvannealed), supplied by the hot-dip process conforming to ASTM A653, Grade 37, with coating applied in accordance with A 924.
 2. Hinge reinforcement: 7 gage, minimum 0.167 inch (4.2 mm) thick.
 3. Lock and strike reinforcement: 12 gage, minimum 0.093 inch (2.3 mm) thick.
 4. Door closer reinforcement: 12 gage, minimum 0.093 inch (2.3 mm) thick.

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5. Floor clips: 16 gage, minimum 0.053 inch (1.3 mm) thick.
 6. Splice plates or channels: same gage as door frame.
 7. Removable Glazing stops: Rectangular channel sections, not less than 20-gage, 0.032 inch thick (0.8 mm) steel; pre-drilled and loosely attached within the glazing cut-outs with countersunk tamper-resistant stainless steel screws; sized to properly accommodate the designated thicknesses of glass and glazing materials; and external edges set flush with, or slightly behind, door face. Modify glazing stops for UL Label doors to conform with UL fire rating requirements.
 8. Mortar guards: 26 gage, minimum 0.016 inch (0.4 mm) thick.
- C. Frame construction:
1. Fire-rated frame assemblies: Modify specified construction to meet all construction requirements required for fire-resistive rating.
 - a. Affix appropriate UL, FM or Warnock Hersey labels to each rated frame assembly, indicating applicable rating.
 2. Shop-fabricate frames as whole single units per door opening, except when frame size is too large to ship as a single unit. Oversized frames may be shipped in large sections as practicable for field assembly with concealed splice plates or channels.
 - a. Frame corner construction: Refer to paragraph A of this Article.
 - b. Jamb return, Refer to Drawings.
 3. Reinforcements, stiffeners, and base angle clips: Welded to interior surfaces of frames to provide a stable base and so as to not interfere with installation of hardware.
 4. Provide mortar boxes, welded to frame, at back of hardware cut-outs where mortar or other materials may obstruct hardware operation.
 5. Appearance of finished frames: Strong, rigid, completely free from warp and buckle, with miters well-formed and in true alignment, and with surfaces smooth and free from defects of any kind.
 6. Silencer holes: Prepare frames for silencers at non-gasketed doors, coordinate with Section 08 71 00 – DOOR HARDWARE and Hardware Schedule. Provide three single silencers for single doors, and mullions of double doors on strike side. Provide two single silencers on frame head at double doors without mullions.
 7. Glazing beads: Carefully place to properly accommodate the various thicknesses of glass and glazing materials, and loosely-attach to frames with flathead galvanized steel screws through pre-drilled holes having countersunk depressions.
- D. Anchorage:
1. Anchor clips for frames in metal stud partitions: 16-gage (minimum 0.053 inch [1.3 mm] thick) steel z-shaped clips factory welded onto frame, 1-1/2 inch upturned and downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
 2. Anchor clips for frames in cold-formed metal framed exterior walls: Steel clips, 16-gage (minimum 0.053 inch [1.3 mm] thick), 1-1/2 inch upturned and

downturned legs, or equivalent type standard with the manufacturer, contained within the frames, for screw attachment to metal studs under Section 05 40 00 - COLD-FORMED METAL FRAMING.

3. Anchors for frames in masonry walls: Countersunk epoxy bolts into masonry.
4. Provide the following number of anchors, clips, or bolts, per jamb:
 - a. For frames 7'-6" in height or less: 3 anchors per jamb.
 - b. For frames 7'-6" in height or less and having doors exceeding 3'-0" feet width, and for cross corridor frames: 4 anchors per jamb.
 - c. For frames greater than 7'-6", up to 10'-0" in height: 4 anchors per jamb.
 - d. For frames greater than 7'-6", up to 10'-0" in height, and having doors exceeding 3'-0" feet width, and for cross corridor frames: 5 anchors per jamb.
 - e. For frames over 10'-0' in height: 5 anchors per jamb.

2.7 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabrication Tolerances, Maximum variation for doors and frames: Maximum diagonal distortion 1/16 inch measured with straight edge, corner to corner.

2.8 FINISHES

- A. Preparation: Pressure-sand all surfaces of all doors, frames, accessory items, anchors, and related items, to remove blemishes and foreign matter and provide paint grip. Spot-fill imperfections with metallic filler, and sand smooth. Thoroughly clean the surfaces by applying hot or cold phosphate treatment standard with the manufacturer.
- B. Following cleaning apply one dip or spray coat of rust-inhibitive metallic oxide, zinc chromate, or synthetic resin primer to all surfaces, including those which will be concealed after erection. Bake, or oven dry, the primer at time and temperature recommended by the manufacturer for developing maximum hardness and resistance to abrasion.

PART 3 - EXECUTION

3.1 ERECTION AND INSTALLATION

- A. Installation of frames and doors, including all accessories and related items furnished hereunder, will be performed under Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
 1. Section 08 05 13 – COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION shall place frames in correct position within specified tolerances, and provide temporary bracing at locations where frames are indicated to be built-into masonry. Section 04 20 00 - UNIT MASONRY shall build and grout frames into masonry work.
- B. Final installation of loosely-attached glazing stops will be performed under Section 08 80 00 - GLAZING.

End of Section

Section 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide the following:
 - 1. Flush solid core wood doors, complete with necessary blocking, hardware cut-outs, and factory glazed openings where so indicated, installed under requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking, and nailers.
- D. Section 06 20 00 - FINISH CARPENTRY: Wood thresholds, frames, casing and trim.
- E. Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal frames scheduled to receive wood doors.
- G. Section 08 71 00 - DOOR HARDWARE: Furnishing finish hardware, and installation templates for hardware cut-outs.
- H. Section 12 24 00 – WINDOW SHADES: Manual shades mounted to glazed classroom doors.

1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with

other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
2. ANSI A 208.1 - Wood Particleboard.
3. ASTM E 152 - Methods of Fire Tests of Door Assemblies.
4. ASTM C 1036 - Flat Glass.
5. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
6. ASTM D 523 - Specular Gloss.
7. ASTM D 5456 - Evaluation of Structural Composite Lumber Products..
8. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
9. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
10. NFPA publication 80 - Fire Doors and Windows.
11. WDMA Industry Standard IS 1A-13.
12. UBC 43.2 - Fire Tests of Door Assemblies.
13. UL 10B - Fire Tests of Door Assemblies.
14. UL 10C - Positive Pressure Fire Door Test Method.
15. Warnock-Hersey - Certification Listings for fire doors.
16. All applicable federal, state and municipal codes, laws and regulations for exits.

B. Definitions:

1. FSC: Forest Stewardship Council
2. NAUF: No added Urea Formaldehyde.

1.2 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Fabricator's product data sheets, specifications, and performance data.
2. Certification: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. General: Fabricator's written certification stating that doors, meet or exceed the requirements specified under this Section; that specified shop finishing has been performed; and that all fire-resistive requirements for the indicated Labels have been met.
 - b. Provide signed certification by agent of door manufacturer stating that machining, glazing and finishing of doors shall be performed by only by the manufacturer in its facilities.
3. Door schedule: All doors specified under this Section, coordinated with the both door and hardware schedules contained in the Contract Drawings.

- a. Indicate doors to be factory finished and finish requirements.
- b. Indicate fire protection ratings for fire rated doors.
4. Shop drawings: Elevations, and large scale sections and details of door construction, indicating profiles, core construction, joinery, edges, and cut-outs for hardware and glazing.
 - a. Indicate dimensions and locations of mortises and holes for hardware.
 - b. Indicate dimensions and locations of cutouts.
 - c. Indicate requirements for veneer matching.
5. Verification samples:
 - a. Corner section of specified flush type door, showing core construction and joinery.
 - b. For transparent finishes: submit two 8 by 10 inch mounted finished samples of each specie of veneer specified.
 - c. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.
 - d. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.3 QUALITY ASSURANCE

- A. All materials and workmanship shall conform in all respects to the specified grades of the Window and Door Manufacturer's Association (WDMA) Industry Standard IS 1A-13, except as modified herein.
- B. Sole Source: Obtain doors specified in this Section from a single manufacturer.

1.4 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for furnishing hardware and installing wood doors.
- B. Ensure that the work performed hereunder is coordinated with issued templates authorized by the hardware supplier.
- C. Do not fabricate doors before receiving a copy of the approved hardware schedule, submitted by the hardware supplier, reviewed by the Contractor and approved by the Architect. Verify that issued templates are coordinated with the approved schedule; immediately notify the Architect, in writing, of any conflicts.

1.5 DELIVERY, STORAGE AND HANDLING

- A. The Contractor is responsible to make certain that wood doors are not delivered until the building and storage areas are sufficiently dry so that the doors will not be damaged by excessive changes in ambient humidity and relative moisture content.
- B. Deliver wood doors in resilient non-staining moistureproof packaging, provide protection during transit and job storage. Clearly identify doors with door opening number, matching those indicated on the approved Door Schedule.

- C. Inspect doors upon delivery for damage. Minor damage may be repaired provided the refinished items are equal in respects to new work and acceptable to the Architect; otherwise remove and replace damaged items.
- D. Store doors flat on a level surface, in protected, elevated, dry areas; protect from exposure from all sources of light and moisture. When required to maintain manufacturer's warranty, seal top and bottom edges if stored more than one week. Break packaging seal on-site to permit ventilation.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

- A. Provide the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranties shall include delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction, all as defined by AWI Quality Standards.
 - 1. Warranty length:
 - a. Interior doors: Manufacturer's lifetime warranty.
 - 2. Warranty coverage shall include all labor and material costs of delivery, re-hanging, re-finishing, glass and glazing to produce a complete installation of replaced or repaired doors.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Algoma Hardwoods, Inc. (Division of Masonite Architectural.), Algoma WI.
 - 2. Marshfield DoorSystems, Inc., (Division of Masonite Architectural.), Marshfield WI.
 - 3. Eggers Industries, (Division of VT Industries), Two Rivers WI.
 - 4. Lambton Doors, Lambton Quebec Canada.
 - 5. VT Industries Inc., Holstein IA.
 - 6. Graham Manufacturing (Division of Masonite Architectural), Mason City IA.

2.3 DESCRIPTION

- A. General Description: Flush wood doors conforming to the requirements set forth in the designated Sections of the (WDMA) Industry Standard IS 1A-13, and the applicable requirements of U.S. Commercial Standard CS 171, as amended. Refer to the Drawings for sizes, locations of each type door, and other characteristics of doors to be furnished hereunder.
1. Door Grade: Premium.
 2. Door Facing:
 - a. Face veneer: veneer 1/41 to 1/32 inch (0.62 to 0.8 mm) thick, mechanically spliced.
 - 1) Wood Species and cut: Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Hardwoods Specialty Products US, Brampton ON Canada, Product: "EchoWood Reconstituted Wood Veneer, Quarter Sawn Maple, number MP168S"
 - 2) Matching of adjacent pieces of veneer: book matched.
 - 3) Panel face assembly: Balanced.
 - b. Crossbanding: Hardwood veneer or composite product at least 1/16 inch thick.
 3. Top and bottom stiles: SCL, Structural Composite Lumber.
 - a. Top stiles at doors having closers: minimum 3.5 inches width.
 - b. Bottom stiles: minimum 1 inch width.
- B. Regulatory Requirements:
1. Fire rated door construction shall conform to UL publications 10B (neutral pressure testing) and 10C (positive pressure testing).
 2. Install doors in compliance with NFPA publication 80.
 3. Corridor door assemblies shall be tested and listed per UL 1784.

2.4 FIRE-RESISTANCE RATED 45, 60 AND 90 MINUTE LABEL DOORS

- A. General Construction: WDMA Industry Standard IS 1A-13, S-21 Veneer, Fire Rated Mineral Core, Premium Grade Door.
1. Door thickness: 1-3/4 inches, unless indicated otherwise.
 2. WDMA Specification Descriptions.
 - a. 90 minute "B" label doors: Type "FD-90 MIN-5, HPDL".
 - b. 60 minute label doors: Type "FD-60 MIN-5, HPDL".
 - c. 45 minute "C" label doors: Type "FD-45 MIN-5, HPDL".
- B. Door facing: As specified herein above under Article – "Flush Faced Doors".
- C. Core construction:
1. Core: Fire resistant Non-combustible asbestos free, mineral composite material per label listing requirements. Positive pressure fire doors shall include intumescent when required, meeting UL Category A requirements..

2. Stiles: multiple-ply stiles with 1/16 inch solid hardwood outer ply matching face veneers for species and color.
 3. Top and bottom rails: Maple, birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements.
 4. Blocking: Provide blocking as required to meet WDMA Extra Heavy Duty performance for securing surface applied hardware without the use of through bolts.
 - a. For doors scheduled to receive screw-mounted surface closers, provide top rail blocking.
 - b. For doors scheduled to receive surface mounted fire exit devices or vertical rods, provide top, intermediate and bottom rail blocking for screw mounting.
 - c. Provide additional blocking for all other surface mounted hardware.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.
- E. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

2.5 FIRE-RESISTANCE RATED 20 MINUTE LABEL DOORS

- A. General Construction: WDMA Industry Standard IS 1A-13, S-21 Veneer, Fire Rated Mineral Core, Premium Grade Door.
1. Door thickness: 1-3/4 inches, unless indicated otherwise.
 2. WDMA Specification Description: "FD-20 MIN".
- B. Door facing: As specified herein above under Article – "Flush Faced Doors".
- C. Core construction:
1. Core: Structural Composite Lumber (SCL) engineered hardwood laminated strand board having no added Urea-Formaldehyde Resin and complying with ASTM D5456.
 2. Stiles: Stile construction that meets or exceeds WDMA Extra Heavy Duty performance. Structural composite lumber with minimum 1/2" hardwood outer stile of same specie as face veneer, minimum overall 1 inch after trimming
 3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 7/8 inch width, after trimming.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.
- E. Accessories: For all fire-rated doors installed in pairs with both leaves active, provide 20-gage formed steel edges, without astragal, wrapped with veneer matching faces of doors.

2.6 NON-RATED SOLID-CORE DOORS

- A. General Construction: WDMA Industry Standard IS 1A-13, S-9 Veneer, Particleboard Core Bonded, Premium Grade Door.

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1. WDMA Specification Description: "PC-5".
 2. Door thickness: 1-3/4 inches, unless indicated otherwise.
- B. Door facing: As specified herein above under Article – "Flush Faced Doors".
- C. Core construction:
1. Core: Particleboard complying with ANSI A208.1 Type 1, Grade 1-LD-2 High density particleboard, minimum 37 pounds per cubic foot, which meets or exceeds WDMA Extra Heavy Duty performance requirement for face screw holding.
 - a. Provide only no added urea-formaldehyde particleboard. Furnish certification of formaldehyde free products.
 2. Stiles: Stile construction that meets or exceeds WDMA Extra Heavy Duty performance. Structural composite lumber with minimum 1/2" hardwood outer stile of same specie as face veneer, minimum overall 1 inch after trimming.
 3. Top and bottom rails: Maple, Birch, Structural Composite Lumber (SCL) or UL approved composite material to meet label requirements, minimum 7/8 inch width.
- D. Adhesives: Type 1 (waterproof) for both face and core assembly.
- 2.7 FLUSH WOOD FULL GLASS DOORS
- A. General Construction: WDMA Industry Standard IS 1A-13, S-13 Veneer, Structural Composite Lumber Core Bonded, Premium Grade Door.
1. WDMA Specification Description: "SHC-5".
 2. Door thickness: 1-3/4 inches, unless indicated otherwise.
- B. Openings for glazing: Only factory prepared glass doors will be accepted. Field-cutting of glazed openings is prohibited.
1. Openings for Corridor doors: Door stops are to be located to permit glazing from Corridor Side only.
- C. Door facing: As specified herein above under Article – "Flush Faced Doors".
- D. Core construction:
1. Core: Laminated strand lumber.
 - a. Acceptable alternative is Marshfield DoorSystems, DFJ-1 Core with reinforcement.
 2. Edge Bands: The stile edge bands shall be Solid edge bands or 4-ply edge band laminated to the core on four (4) sides per AWI 1300-G-3 Spec. Symbol PC-5 with Type II highly water-resistant glue, using the high frequency method. Four-ply rails of mill-option hardwoods shall be used. Solid edge bands or outer ply for stiles shall be hardwood matching face veneers for species and color.
 3. Top and bottom rails: Maple, birch or TimberStrand Laminated Strand Lumber, producing a smooth surface.
- E. Adhesives: Type 1 (waterproof) for both face and core assembly.

F. Warranty: Manufacturer's standard Life Time Warranty.

2.8 GLAZING

A. Glazing:

1. Fire Resistant Rated Doors: 8mm-9 mm thick (5/16 inch-3/8 inch) transparent wire-less fire rated ceramic glazing material with polished finish.
 - a. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1) Nippon Electric Glass Co., Ltd., "Firelite Plus".
 - 2) Vetrotech Saint-Gobain, "SSG Keralite FR-L".
 - 3) SAFTI First, "Pyran Platinum L".
 - b. For fire rated door assemblies, conform with latest edition of ASTM E152, ASTM E163, NFPA-80, NFPA 252, NFPA 257.
 - c. Conforms to ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 - d. Permanently identify each individual glazing unit with a listing mark visible after installation.
 - e. In accordance with manufacturer's specifications, Firelite Plus must be glazed into frames with a similar rating, using silicone glazing compound which shall be supplied with the Firelite Plus material.
 2. Non Fire-Resistant Rated Doors:
 - a. Laminated Glass, General: consisting of an outer face and inner face of specified glass, factory laminated to polyvinyl butyl (PVB) interlayer, structural PVB, Ethylene Vinyl Acetate (EVA), or iconplast interlayer (SGP) as specified. Laminated glass shall be free from foreign substances and air pockets, and certified by Safety Glazing Certification Council.
 - 1) Acceptable Interlayer Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 - a) Kuraray America, Inc., Wilmington DE.
 - b) Eastman Chemical Company, Kingsport TN.
 - c) Schweitzer-Mauduit International, Inc. (SWM), Alpharetta GA.
 - b. Laminated Glass Lites: Nominal 1/4 inch thick laminated safety glass.
 - 1) Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 - 2) Interlayer: 0.030 inch thick clear interlayer
 - 3) Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass.
- B. Glazing beads for "B" and "C" fire rated doors, wood veneered bead:
1. Algoma's style number W-9, labeled, with 1/2 inch sight line.
 2. Eggers #100 style.
 3. Marshfield DoorSystems veneer clad light bead.
 4. VT Industries Type: "Veneer Wrapped #110".
- C. Glazing beads for 20 minute fire rated and non-fire rated doors:

1. Algoma's style number W-4 wood bead with 3/8 inch sight line.
 2. Eggers style number 100, 5/8 inch sight line.
 3. Marshfield DoorSystems style number W-6, 3/8 inch sight line.
 4. VT Industries Type "V!-1"
- D. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1.
- E. Setting blocks: Neoprene, 80-90 shore A durometer hardness.

2.9 FABRICATION

- A. Fabricate doors in accordance with specified manufacturer's requirements. Fabricated rated doors in compliance with WHI, or UL requirements as appropriate.
- B. Laminate door facing, cross banding and assembled core in a hot press.
- C. Bond stiles and rails to cores, sand for uniform thickness. Factory sand assembled door leaf.
- D. Factory-machine doors to receive hardware from templates furnished under Section 08 71 00 - DOOR HARDWARE. Do not machine for surface hardware.
1. Provide inner blocks at lock edge and top of door for closer hardware reinforcement.
 2. Cut and configure door edges to receive scheduled gasketing and intumescent edging specified under Section 08 71 00 – DOOR HARDWARE.
- E. Factory fabricate doors for undercut where scheduled.
- F. Factory cut all glazed openings as scheduled. Field cutting of openings is prohibited.
- G. Glazing: Provide as scheduled.
1. Install glass in strict accordance with manufacturer's printed instructions.
 2. Install glazing bead with mitered corners.
 3. Countersink nails and fill holes with color matched putty.
- H. Fabrication tolerances: Maximum diagonal distortion (warp): 1/4 inch (6 mm) measured with straight edge from corner to corner over a maximum 42 by 84 inch surface area.

2.10 FACTORY FINISHING

- A. General: Factory finish to be to comply with EPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations.
- B. Transparent finish: WDMA Factory Finish System TR-6 Catalyzed Polyurethane having water based stain and ultraviolet (UV) cured polyurethane sealer and topcoat, with a satin sheen of 31° to 35° gloss units per ASTM D523.
1. Finish system shall include the following:
 - a. Finish sanding.

- b. Stain application.
- c. Stain curing.
- d. Sealer application - first coat.
- e. Sealer gel cure.
- f. Sealer application - second coat.
- g. Sealer gel cure
- h. Sealer application - third coat
- i. Sealer full cure
- j. Sealer sanding
- k. Topcoat application - first coat
- l. Topcoat application - second coat
- m. Topcoat full cure

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install wood doors, including all accessories and related items under the requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.

3.2 TOUCH-UP FINISHES

- A. Field touch-up of doors, scheduled for transparent finishes, will be performed by an authorized representative of the door fabricator. Touch-up includes refinishing surfaces resulting from fitting, or job inflicted scratches and marks.

End of Section

Section 08 31 00
ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Fire resistive rated and non-rated access panels and frames, as specified under this Section, furnished by Sections requiring the same and installed under the following Sections:
 - 1. Section 04 20 00 – UNIT MASONRY: Installation of access panels into masonry assemblies.
 - 2. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
- B. Furnish non-rated ceiling access hatches for installation under Section 09 29 00 – GYPSUM BOARD.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 – UNIT MASONRY: Installation of access panels into masonry assemblies.
- D. Section 09 29 00 - GYPSUM BOARD: Installation of access panels into drywall assemblies.
- E. Division 21 - FIRE SUPPRESSION: Furnishing access panels required for fire protection systems.
- F. Division 22 - PLUMBING: Furnishing access panels required for plumbing systems.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Furnishing access panels required for heating/cooling systems.
- H. Division 26 - ELECTRICAL: Furnishing access panels required for electrical systems.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications and installation instructions.
 2. Schedule: Submit Schedule of all access panels to be furnished hereunder, indicating locations for each size and type of access door.
 - a. The Contractor is responsible to ensure that all of the types/styles of panels and frames specified herein can be furnished by the manufacturer submitted.
 - b. Prior to submitting schedule, coordinate with the work of Division 21 - FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 - HEATING, VENTILATING AND AIR CONDITIONING and Division 26 - ELECTRICAL and meet with the Architect to determine exact quantities and locations required for the installation of access panels.
 3. Shop drawings: Large scale details of access doors, indicating all sizes, gages and thickness; provide complete installation details, coordinated to the specific receiving conditions.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver access doors to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store access door units inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Acudor Products Inc., Cedar Grove, NJ
 2. Cesco Products, North Brooklyn Park MN.
 3. J.L. Industries, Bloomington MN.
 4. Karp Associates Inc., Maspeth NY.
 5. Miami-Carey Corp., Monroe OH.
 6. Nystrom Products Company, Minneapolis MN.
 7. Milcor, Inc. Lima OH.
 8. Larson Manufacturing Co., Brookings SD.
 9. Williams Brothers Corporation of America, Front Royal, VA.
- B. Single Source: All work of this Section shall be produced by a single manufacturer, unless otherwise approved by the Architect.

2.2 ACCESS PANELS - GENERAL

- A. Access panels scheduled for placement in masonry: Furnish with masonry anchors attached to unit frames at factory.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 ACCESS PANELS - FOR FIRE RESISTANCE RATED CONSTRUCTION

- A. For fire-resistance rated wall and ceiling surfaces: Standard flush panel door meeting the following requirements:
1. Panel and frame rating: UL "B" label for 90 minutes.
 2. Frame type:
 - a. For masonry walls: 16 gage galvanized bonderized steel flanged frame, with flange exposed to view 1 inch or less.
 - 1) Acudor FW-5050 series
 - 2) Karp KRP-150FR series.
 - 3) Nystrom IT series.
 - 4) Williams WB-FR series.
 - b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor FW-5050DW
 - 2) Karp KRP-350FR series.
 - 3) Nystrom IW series.
 - 4) Williams WB-FR series.
 3. Door: Insulated Flush panel door as follows:
 - a. Typical wall types : Flush door, Sandwich construction with 2 inch thick mineral wool fiber insulation between two layers of 20 gage galvanized bonderized steel.
 4. Hinge: Flush continuous piano hinge with stainless steel pin.
 5. Closer: Spring closer.
 6. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.

2.5 ACCESS PANELS - FOR NON- RATED CONSTRUCTION

- A. For non-rated wall and ceiling surfaces (service and non-public areas): Flush panel door type meeting the following requirements:
1. Frame type:
 - a. For masonry walls: 16 gage galvanized bonderized steel flanged frame, with flange exposed to view 1 inch or less.
 - 1) Acudor UF-5000 series.
 - 2) Karp DSC-214SM series.
 - 3) Nystrom NT series.
 - 4) Williams WB-GP series.

- b. For gypsum board walls and ceilings: 16 gage galvanized bonderized steel frame, with 22 gage galvanized steel drywall bead.
 - 1) Acudor DW-5040 series.
 - 2) Karp KDW series.
 - 3) Nystrom NW series.
 - 4) Williams WB-PL series.
- 2. Door: Flush panel door as follows:
 - a. Typical all wall types, except tile: 14 gage galvanized bonderized steel.
 - b. For tiled walls: 14 gage type 304 stainless steel.
- 3. Hinge:
 - a. Typical: Concealed spring hinge enabling door to open 175 degrees and permit removal of door from frame.
 - b. Panels greater than 24 by 36 inches: Flush continuous piano hinge with stainless steel pin.
- 4. Latch: Flush cam latch, operated by Allen or Torx head screwdriver.

2.6 FACTORY FINISHING

- A. Panel assemblies fabricated from galvanized bonderized steel: Baked on rust inhibitive gray primer finish.
- B. Panel assemblies fabricated from cold rolled steel: Phosphate dipped with baked on rust inhibitive gray primer finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking is set in place and secure.
- B. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Install access panels in accordance with manufacturer's instructions and direction from authorities having jurisdiction. Install miscellaneous specialties absolutely level and in true line, with units securely anchored to the surrounding construction.
- B. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.

End of Section

Section 08 33 23
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install coiling door assemblies, complete with all related items, including but limited to:
 - 1. Insulated steel slat door(s).
 - 2. Tracks.
 - 3. Clip angles.
 - 4. Guides.
 - 5. Electrical operation hardware and mechanisms.
 - 6. Coil housing.
 - 7. Operating control station.
 - 8. Weather seals.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 12 00 - STRUCTURAL STEEL: Structural framing.
- D. Section 05 50 00 - METAL FABRICATIONS: Support framing and framed opening.
- E. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and backup materials.
- F. Section 08 71 00 - DOOR HARDWARE: Furnishing cylinders for coiling door[s].
- G. Division 26 - ELECTRICAL:
 - 1. Conduit from electric circuit to door operator and from door operator to control station.
 - 2. Electrical power wiring and conduit from the building power supply to the motors, and from the motors to the operating control stations.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 - 1. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
 - 3. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 4. ANSI/UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.
 - 5. NEMA 250 - Enclosures for Electrical Equipment.
 - 6. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
 - 7. NEMA MG1 - Motors and Generators.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
 - 1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, and performance data.
 - 2. Manufacturer's installation instructions. Indicate installation sequence and procedures, adjustment and alignment procedures and lubrication instructions.
 - 3. Maintenance Data: Lubrication requirements and frequency, periodic adjustments required.
 - 4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 - 5. Shop drawings: Fully-dimensioned, large scale details of each type door construction, tracks, guides, counterbalancing and operating mechanisms,

electrical characteristics, hood enclosures, and related items; with complete installation details reflecting actual site conditions for each location.

6. Selection samples:
 - a. Sample card indicating Manufacturer's full range of finishes available for selection by Architect.
 - b. Provide additional samples as requested by Architect for initial selection of colors and finishes.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of overhead coiling doors.
- C. Qualifications:
 1. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.8 WARRANTY

- A. Provide the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranties shall include materials and workmanship, satisfactory operation, and contain any limitations of items specified herein.
 1. Manufacturer's limited door warranty for 2 years for all parts and components.
 2. Manufacturer's door and operator warranty to be free of defects in materials and workmanship, for a period of 3 years, or 20,000 operation cycles, whichever occurs first. Warranty excludes counterbalance and finish.

1.9 MAINTENANCE

- A. Provide Installers maintenance contract under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, commencing on Date of Substantial Completion and extending for a period of one year. Maintenance contract shall include the following:
 1. Emergency callback service for the doors.
 2. Annual examinations of the installation during regular working hours by trained employees of the door manufacturer.
 3. All necessary adjusting, greasing, and oiling.
 4. Cleaning supplies and parts necessary to keep the equipment in proper operation, except any parts needed due to misuse, accident, or neglect caused by others.
- B. Repair work shall be carried out only by the door installer's personnel, using only standard parts furnished by the door manufacturer. Maintenance shall be carried out directly by the installer and shall not be assigned or transferred to any agent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer and door model: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Overhead Door Company, Lewisville, TX., series "Stormtite 620"
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products are limited to the following:
 - 1. Cornell Iron Works, Inc., Mountaintop PA.
 - 2. Overhead Door Company, Lewisville, TX.
 - 3. Raynor Garage Doors, Dixon IL.
 - 4. Wayne-Dalton Corp., Mt. Hope OH.

2.2 SYSTEM DESCRIPTION

- A. Design and size components to withstand dead and live loads caused by pressure and suction of wind acting normal to plane of wall as calculated in accordance with Massachusetts State Building code as measured in accordance with ASTM E 330, without undue deflection or damage to door or assembly.
- B. Performance Requirements:
 - 1. Door Operation: Design door assembly, including operator, to operate for not less than 50,000 cycles.
 - 2. Door System Thermal Performance:
 - a. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
 - 3. Maximum air leakage per foot of door perimeter (sill, jamb and header) shall not exceed 0.81 CFM (6.36 cm²/min) at 25 MPH (402 KM/hr). No air leakage shall be detected between section joints when tested in accordance with ASTM E-283.
 - 4. Door System Acoustical Performance:
 - a. Through Curtain Sound Rating: Sound Rating: STC-28 as per ASTM E 90.
 - b. Installed System Sound Rating: STC-21 as per ASTM E 90.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 OVERHEAD DOORS

- A. Curtain:
 - 1. Steel slats: Interlocking flat-faced insulated slats (Overhead Door Corp. F265I profile or approved equal), sandwich slat construction with:
 - a. Minimum 22 gage of ANSI/ASTM A526 steel, sandwich construction, nominal 3 inches high by a minimum of 15/16 inch thick and galvanized to a minimum of 1.25 oz/SF coating in accordance with ASTM A525.

- b. Insulated core of foamed in place urethane insulation, without any voids. Insulation to provide curtain assembly with a minimum "U" factor of 0.158, and an "R" value of 6.33 calculated per ASHRAE standards.
 2. Endlocks: Continuous molded, high strength nylon riveted to both ends of each slat,
 3. Bottom slat: Fitted with angles to provide reinforcement and positive contact with floor in closed position, equipped with compressible vinyl coated safety/weather edge.
- B. Counterbalance: Oil tempered helical torsion springs, housed in steel pipe barrel, supporting the curtain with a deflection not exceeding 0.03 inch per foot of width, equipped with ball or roller bearings, and adjustable by means of external tension wheel.
- C. Brackets: Minimum 3/16-inch thick steel plate, for supporting barrel, counterbalance mechanism, and hood, with a high factor of safety.
- D. Hood: 24 gage, minimum, galvanized steel, beaded, and flanged to prevent deflection. Equip hood with neoprene/rayon air baffle between top of hood and curtain.
- E. Guides: Continuous, vertical mounted galvanized, formed from 3/16 inch thick angles. Provide guides with vinyl weather strips to seal against interior and exterior faces of curtain. Provide windlock bars per manufacturer's standards.
- F. Door Operation:
 1. Motor: UL listed electric operator, sized as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per section. Motor 115/230 VAC, 60 hz single phase, totally enclosed, instant reversing, with electric interlock to prevent operation when locked.
 2. Reversing safety contact: Heavy-duty, electrically and mechanically interlocked.
 3. Limit switches: Adjustable rotary type, synchronized with door.
 4. Control circuit: 24 VAC, Class 2.
 5. Reduction: Worm gear running in oil bath, primary; chain and sprocket, secondary.
 6. Clutch: Adjustable friction type.
 7. Brake: Solenoid actuated drum type.
 8. Door Control, via the following:
 - a. Push-button and key operated control stations with open, close, and stop buttons.
- G. Locking: Cylinder lock designed to accommodate cylinders provided by Section 08 71 00 - DOOR HARDWARE. for electric operation with interlock switch.

2.5 ACCESSORIES

- A. Brackets and support clips: Provide guide rail, counterbalance shaft assembly, and hood supports as required for a complete assembly, finish of supports to match products being supported.

2.6 FABRICATION

- A. Do not fabricate doors until all specified submittals have been submitted to, and approved by, the Architect.

2.7 SHOP FINISH

- A. All exposed to view door components (including hood): baked-on polyester powder coat, minimum 2.5 mils (0.065 mm) cured film thickness; ASTM D-3363 pencil hardness: H or better.
 - 1. Custom mica, 'metallic appearance' powder coat color to match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Perform installation of all items furnished hereunder, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.
- B. Set entire assembly including doors, guides, and hardware, plumb and true to line, to assure smooth operation. Brace guides internally to provide a completely rigid installation. Attach jambs with not less than 3/8 inch steel bolts spaced not more than 30 inches apart.
- C. Coordinate installation of electrical service for overhead coiling doors with Division 26 - ELECTRICAL. Complete power and control wiring from disconnect to unit components.
- D. Coordinate installation of sealant and backing materials at frame perimeter of coiling overhead door as specified in Section 07 92 00 - JOINT SEALANTS.

3.2 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work. Maximum variation from plumb or level: 1/16 inch. Maximum variation in longitudinal or diagonal warp: 1/8 inch per 10 foot straight edge.

3.3 ADJUSTING

- A. Adjust doors, hardware and operating assembly as required to ensure a smooth operation without binding.

3.4 CLEANING

- A. Remove all protective films and coverings from assembly components. Clean doors and guides.
- B. Remove tools, equipment and all rubbish and debris from the work area, caused by the work of this Section; leave area in broom-clean condition.

3.5 PROTECTION

- A. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

End of Section

Section 08 34 57

SECURITY WOVEN MESH COILING DRAPERY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.

1.2 SECTION INCLUDES

- A. Furnish and install manually-operated woven mesh coiling drapery, complete with overhead track assembly, drapery carriers, woven wire drapery, locks and foot-bolts, and all related items, for interior locations where indicated.

1.3 RELATED SECTIONS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Steel framing.
- D. Section 05 50 00 - METAL FABRICATIONS: Overhead supports for security drapery track.
- E. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- F. Section 07 92 00 - JOINT SEALANTS: Perimeter sealant and backup materials.
- G. Section 08 71 00 - DOOR HARDWARE: Cylinders for coiling draperies.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI/UL 325 - Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, and performance data.
 2. Manufacturer's installation instructions. Indicate installation sequence and procedures, adjustment and alignment procedures and lubrication instructions.
 3. Maintenance Data: Lubrication requirements and frequency, periodic adjustments required.
 4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 5. Shop drawings: Fully-dimensioned, large scale details, tracks, guides, counterbalancing and operating mechanisms, electrical characteristics, hood enclosures, and related items; with complete installation details reflecting actual site conditions for each location.
 6. Selection samples:
 - a. Sample card indicating Manufacturer's full range of finishes available for selection by Architect.
 - b. Provide additional samples as requested by Architect for initial selection of colors and finishes.
 7. Verification samples:
 - a. 12 x 12 inch samples of grille illustrating material and finish.
 - b. 12 inch long samples of bottom bar.

1.6 QUALIFICATIONS

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.8 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 - WARRANTIES.
1. Provide 5 year warranty which shall include materials and workmanship, satisfactory operation, and contain any limitations of items specified herein.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 WOVEN MESH COILING DRAPERY

- A. Basis of Design (specified manufacturer and grille model): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Cascade Coil Drapery, Tualatin OR., Product: "GuardianCoil Drapery Security System".
 - 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Cascade Coil Drapery, Tualatin OR.
 - b. GKD Metal Fabrics, Cambridge MD.
 - c. MarCo Specialty Steel, Houston TX.
- B. Curtain: Woven Wire Curtain, 15 gauge aluminum wire with a 5/16 inch weave size.
 - 1. Curtain Finish: "Satin Bronze".
- C. Track: Formed galvanized steel, Cascade Coil Drapery product "Steel Secura-track" of sizes indicated on the approved shop drawings.
 - 1. Provide extruded slip-on connectors and nylon end stops.
 - 2. Provide standard curved sections as indicated on Drawing.
 - 3. Finish for track and fittings: Clear anodized finish
- D. Roller carriers: Wheeled nylon carrier with self-lubricating nylon wheels and steel axle, to accurately fit track, designed to eliminate bind when curtain is pulled, and fitted to curtain to prevent accidental curtain removal.
 - 1. Install sufficient quantity of carriers for each curtain, minimum of one carrier for every 6 inches of track.
- E. Hardware option: Cascade coil T071 Hardware Option, Secura, Nylon Wheel Bumper Carriers Attached (Self-Pleating Chain Installed 50%+, No Pleating Chain Installed < 50%).
- F. Locks: Pin tumble single unit mechanism, installed on one jamb, and designed to accommodate cylinders (keyed both sides), provided by Section 087100.02 - DOOR HARDWARE.
 - 1. Provide keyed locking footbolts at intermediate vertical stiffener channels.

2.3 FABRICATION

- A. Do not fabricate security drapery until all specified submittals have been submitted to, and approved by, the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Perform installation of all items furnished hereunder, except as otherwise specified, in accordance with the approved shop drawings and the recommendations of the manufacturer.
- B. Set entire assembly including grilles, track and carriers, and hardware, plumb and true to line, to assure smooth operation. Brace track to provide a completely rigid installation.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work. Maximum variation from plumb or level: 1/16 inch. Maximum variation in longitudinal or diagonal warp: 1/8 inch per 10 foot straight edge.

3.4 ADJUSTING

- A. Adjust security drapery, hardware and operating assembly as required to ensure a smooth operation without binding.

3.5 CLEANING

- A. Remove all protective films and coverings from assembly components, and clean grilles and guides. Remove tools, equipment and all rubbish and debris from the work area, caused by the work of this Section; leave area in broom-clean condition.

End of Section

Section 08 43 13

ALUMINUM-FRAMED STOREFRONTS
(TRADE CONTRACT REQUIRED AS PART OF SECTION 08 00 05)

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 08 00 05 – METAL WINDOWS TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Trade Contract includes all individual specification sections listed in Section 08 00 05 – METAL WINDOWS TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. General: The work of this Section consists of aluminum framed high-thermal performance, storefront system, and fixed glazed windows, where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install the following:
1. Prefinished high-performance aluminum exterior fixed-glazed storefront and window system, of the types specified herein, all required integral reinforcing, bracing members and related accessories for the framing systems, and all angles, clips, and other items required to anchor the systems to the building structure.
 2. Prefinished aluminum entrance / storefront doors and hardware, installed in accordance with requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION, manufacturer's written instructions and as specified in this Section.
 3. Prefinished extruded aluminum battens and pressure plate clips, and flashings, in conjunction with aluminum entrance and storefront framing.
 4. Extruded aluminum starter sills.
 5. Metal to metal sealing of aluminum assemblies.
 6. All glass and glazing materials for the aluminum framing system.
 7. Shimming and fasteners required for installation.
 8. Provide storefront framing with extruded receptors.
 9. Sealant and compressible back-up beads for exterior perimeter joints between framing members furnished hereunder and surrounding dissimilar materials.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 05 50 00 - METAL FABRICATIONS: Steel lintels.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

- D. Section 07 21 00 - THERMAL INSULATION: Perimeter vapor and air seal between window frame and adjacent construction.
- E. Section 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS.
- F. Section 07 42 14 - EXPOSED FASTENER METAL WALL PANELS.
- G. Section 07 42 24 - PHENOLIC PANEL ASSEMBLIES.
- H. Section 07 42 43 - COMPOSITE WALL PANELS.
- I. Section 07 92 00 - JOINT SEALANTS: Interior perimeter sealant and back-up materials.
- J. Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION.
- K. Section 08 71 00 – Door Hardware: Furnishing door hardware for the work of this Section 08 43 13.
- L. Section 08 80 00 - GLAZING: General requirements and standards for glass and glazing materials.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 - 1. AAMA/WDMA/CSA 101/I.S.2/A440-05 - Standard Specifications for windows, doors and unit skylights.
 - 2. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
 - 3. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Window wall, Extrusions and Miscellaneous Aluminum Components.
 - 4. ASCE 7- 05, Minimum Design Loads for Buildings and Other Structures.
 - 5. AAMA 1503.1 - Specification for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
 - 6. ASTM A 167 - Stainless and Heat-Resisting Chromium Nickel Steel Plate, Sheet, and Strip.
 - 7. ASTM A 386 - Zinc Coating on Assembled Steel Products.
 - 8. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 - 9. ASTM B 221 - Aluminum-alloy Extruded Bar, Rod, Wire, Shape, and Tube.
 - 10. ASTM E 283 - Rate of Air Leakage through Exterior Entrance and vestibule, Curtains Walls and Doors.
 - 11. ASTM E 330 Structural Performance of Exterior Entrance and vestibule, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 12. ASTM E 331 - Test method of Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
 - 13. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. AAMA SFM-1 - Aluminum Storefront and Entrance Manual.
 2. GANA Laminated Glazing Reference Manual (2009 edition).
 3. GANA - Glazing Manual (50th Anniversary edition).
 4. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
 5. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.
 6. All applicable federal, state and municipal codes, laws and regulations for exits.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 2. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Architect.
 3. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.6 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.7 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, fabrication methods, finishes, performance data, and installation instructions for each item furnished hereunder.
 - a. Provide additional information for glazing and sealant products; including chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.

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- b. Provide hardware schedule and product data sheets for each type of hardware.
 2. Shop Drawings:
 - a. 1/4 inch scale elevations and plans of each storefront system condition.
 - 1) Indicate all types and thickness of glass.
 - 2) indicate all door hardware mounting heights.
 - b. Large scale design details; indicating sizes, types, and gauges of all metal components; expansion provisions, and glazing details.
 - 1) Provide details of perimeter conditions and typical joinery. Indicate which framing members run through and how joints are sealed.
 - 2) Provide details of transition areas and modifications to standard system components.
 - 3) Provide details of bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 - 4) Indicate building column line reference dimensions.
 - c. Provide reaction loads imposed on the structure, including all deadload, seismic, and windload reactions at each anchor location.
 - d. Design engineering shall be the responsibility of the framing systems manufacturer, and may vary from those indicated on the Contract Drawings, but basic sight lines shall be retained.
 3. Selection Samples:
 - a. Sample card indicating Manufacturer's full range of coating colors available for selection by Architect.
 - 1) Color as selected by Architect from manufacturer's complete range of options, without additional cost to the Owner. Color required may be considered "bright," "premium," "exotic," "polychromatic," "pearlescent," or "metallic" by the coating manufacturer.
 - b. Provide physical samples as requested by Architect for initial selection of colors and finishes.
 - c. Manufacturer's sample boards for sealant colors, for selections by the Architect.
 4. Verification Samples:
 - a. Provide operating hardware components in specified finishes as requested by Architect.
 - b. After receipt of selected standard colors from the Architect, submit at least two 12-inch long pieces of major metal extruded components of the systems, and 12 by 12 inch samples of finished aluminum sheet used for brake metal components, prefinished in the specified finish system in selected colors.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 77 00 - CLOSEOUT PROCEDURES.
 1. Operation and Maintenance Data: For all hardware components furnished under this Section 08 43 13.
 2. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.8 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Except for glass, obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of storefront framing.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 5 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.

1.9 MOCK-UPS

- A. Provide building components for exterior wall assembly mock-up as indicated on Drawing A-001.
- B. Mock-up will be used for constructability review demonstrating the minimum standard for the Work. envelope performance testing as well as a visual confirmation of colors, textures and finishes.
- C. Maintain mock-up during construction for workmanship comparison.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - a. Obtain receipts for when hardware is received by other trades.
 - 2. Deliver hardware scheduled for field installation packaged individually. Label and identify each package with door opening code to match hardware schedule.
 - a. Obtain receipts for when hardware is received by other trades.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures.
 - 2. Protect materials from damage due to moisture, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - a. Protect finished metal surfaces from damage during fabrication work, shipping, storage, and erection. Protect pre-finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.11 SITE CONDITIONS

- A. Do not install sealant when ambient temperature is less than 40 degrees Fahrenheit.

1. Maintain this minimum temperature during and 48 hours after installation of sealant.

1.12 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
 1. Total window assemblies: Manufacturer's written warranty for aluminum windows, covering repair or replacement of any unit which leaks, or exhibits defects in materials, finish, design, for a period of 10 years from date of substantial completion of the General Contract.
 2. Insulating glass: Glass manufacturer's 10 year written warranty covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
 - a. Provide coverage in manufacturer's Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.
 - b. Guarantee shall include replacement of defective glass and delivery of replacement glass furnished f.o.b. from point of manufacturer to project site.
 3. Finish System Warranty: polyvinylidene flouride enamel finish 20 year coating warranty assigned specifically to project, covering film integrity (including chipping, crazing, pitting, and delamination), chalk resistance and color fading, color change.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Oldcastle Glass Engineered Products, Terrell TX., series "6000XT" system.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
 1. Oldcastle Glass Engineered Products, Terrell TX.
 2. Kawneer North America (A Division of Alcoa), Norcross GA.
 3. EFCO Corp., Monett, MO.
 4. Apogee Wausau Group, Inc., Stratford, WI, (Wausau).
 5. YKK AP America Inc., Austell GA.

2.2 DESCRIPTION

- A. General Description: High thermal performance fixed-glazed storefront system. System is Integrated flush-glazed, outside glazed, with screw-splined corner joints.
 1. System shall provide flush glazing on all sides for the indicated thickness of glass, with no projected glazing stops.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 PERFORMANCE/DESIGN CRITERIA

- A. General: Design, fabricate, assemble and erect storefront system, and interfacing conditions with contiguous work, to ensure continuity of building enclosure vapor and air barriers and that all segments of the assemblies will be free from leakage under every condition of weather and exposure. In addition to the specified performance requirements, storefront system shall conform to, or exceed the requirements of the applicable building code and referenced industry standards for air infiltration, water infiltration, operating forces, deflection and deformation under load.
- B. Engineering criteria: The manufacturer for storefront system shall employ the services of a qualified structural engineer, registered to practice in the Commonwealth of Massachusetts to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.
 - 1. Wind Loading: Storefront system and installation shall be designed to conform to the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as revised by *Massachusetts State Building Code*, Ninth edition.
 - a. Basic wind speed of 137 miles per hour (3 second gust), both positive (acting inward) and negative (acting outward) wind pressure loading.
 - 1) Building Risk Category: III.
 - 2) Building Exposure: C.
- C. Testing Requirements: Provide manufacturer's testing and submit test data. Demonstrate compliance with specified requirements.
 - 1. Test Sequence: Air infiltration testing shall precede water resistance testing.
- D. Test samples:
 - 1. Frame Sample(s) for air infiltration, water penetration and structural tests: Minimum sample size: 12'-0" high by 4'-0" wide.
 - 2. Door Samples for air infiltration tests:
 - a. For single doors: Minimum size 3'-0" x 7'-0.
 - b. For double doors: Minimum size 6'-0" x 7'-0".
- E. Frame:
 - 1. Air infiltration through assembly: tested specimen in accordance with ASTM E 283, with a static pressure difference of 6.24 psf, shall not exceed 0.06 cfm per square foot of unit surface area.
 - 2. Water resistance: test specimen in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 10 psf as defined in AAMA 501.

3. Deflection: test in accordance with ASTM E330 at a static air pressure difference of 36 psf (positive and negative).
 - a. Deflection of framing members perpendicular to the plane of the wall shall not exceed $L/175$ of its clear span.
 - b. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2 percent of their clear spans shall occur.
 4. Uniform structural loading: test in accordance with ASTM E330 at a static air pressure difference of 1.5 times the design wind pressure prescribed by the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as amended by *Massachusetts State Building Code*, Ninth edition. Test will result of no water leakage glass breakage, permanent damage to fasteners, permanent deflection in framing, or other damage which would cause the storefront be defective.
 5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than the following:
 - a. Storefront Systems: 0.36 BTU/h-ft²-F. (Basis of design Oldcastle 6000XT).
 6. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than: CRF of 63 (frame).
- F. Entrance doors:
1. Air infiltration through assembly, tested in accordance with ASTM E283 with a static pressure difference of 1.57 psf.
 - a. For single doors, air infiltration shall not exceed 0.50 cfm per linear foot of perimeter crack.
 - b. For double doors, air infiltration shall not exceed 0.10 cfm per linear foot of perimeter crack.

2.5 FRAMING

- A. Exterior and interior storefront framing systems: Nominal dimension of 2 inch face width (sight-line) by 6 inch total depth, thermally broken high performance (dual thermal break) system, suitable to receive insulating glass.
1. Glazing: Center Glazed.
 2. Utilize shear block type construction throughout. No visible raw edges are permitted at joints.
 3. Install utilizing starter sills having integral panning end dams.
 4. Acceptable products include the following, or approved equal:
 - a. EFCO 406X.
 - b. Oldcastle "6000 XT" System.
 - c. Kawneer "Trifab 601UT" system.
 - d. YKK: "YES 60 XT" system.

2.6 EXTERIOR ENTRANCE DOORS

- A. Aluminum doors shall be thermally broken extruded aluminum, preglazed, single acting, hinged doors, medium stile-and-rail type. Subject to compliance with the

requirements specified herein, products which may be incorporated in the work include, the following:

1. EFCO model "D302 (TS) ThermaStile" doors.
2. Oldcastle model "MS-375 Thermal Medium Stile" door.
3. Kawneer model: "360 Insulclad" doors.
4. YKK: "35XT Megatherm" door.

B. Entrance doors:

1. Wall thickness of stile and rail extrusions: not less than 0.125 inch.
2. Wall thickness of glazing stops: not less than 0.050 inch.
3. Thickness of door: 2-1/4 inches.
4. Width of door stiles: Nominal 3-3/4 inches, 4-1/16 inches maximum.
5. Width of top rail: Nominal 3-3/4 inches, 4-1/16 inches maximum.
6. Width of bottom rail: 10 inches minimum (in conformance with 2012 ADA).
7. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.
8. Weatherstripping: Wool pile type.

2.7 INTERIOR (VESTIBULE) ENTRANCE DOORS

A. Entrance doors shall be extruded aluminum, pre-glazed, single acting, hinged doors, heavy duty, stile-and-rail type; acceptable products are:

1. EFCO model "D318 DuraStile".
2. Oldcastle: "Rugged MS 375".
3. Kawneer mode: "Tuffline 350 Series".
4. YKK: "40M Monumental Door".

B. Entrance doors:

1. Wall thickness of stile and rail extrusions: not less than 0.1875 inch.
2. Wall thickness of glazing stops: not less than 0.050 inch.
3. Thickness of door: Nominal 2 inches.
4. Width of door stiles: Nominal 3-3/4 inches, 4-1/16 inches maximum.
5. Width of top rail: Nominal 3-3/4 inches, 4-1/16 inches maximum.
6. Width of bottom rail: 10 inches minimum (in conformance with 2012 ADA).
7. Fabricate doors with hairline joints at corners of stiles and rails; provide heavy concealed reinforcement brackets secured with screws and welded.
8. Weatherstripping: Wool pile type.

2.8 GENERAL MATERIALS

A. Framing and door members shall be of extruded aluminum 6063-T5, 6063-T6, or 6061-T6 alloy and temper, as recommended by manufacturer for strength, corrosion resistance and specified finish, complying with ASTM B 221.

1. Minimum wall thickness: 0.080 inch (2 mm) thick.

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2. Thermal barrier: poured-in-place, two-part polyurethane. Use of nonstructural thermal barriers are prohibited.
- B. Sill track shall be of special purposed high strength extruded aluminum in either 6351-T5 or 6061-T5 alloy and temper as recommended by manufacturer for strength, corrosion resistance and specified finish, complying with ASTM B 221.
 - C. Formed flashings and closures shall be of aluminum Alloy/temper 5005-H34, minimum of 0.083 inch thick, complying with ASTM B 209.
 1. Provide and install all miscellaneous formed aluminum work in conjunction with the aluminum frame work as detailed and as required to complete the work including but not limited to sills, mullion covers, closures, flashings.
 - D. Aluminum sections shall be of sizes and profiles indicated on the approved shop drawing details; shall present straight, sharply defined lines and arises; and shall be free from defects impairing strength, durability, or appearance.
- 2.9 ALUMINUM BRAKE-METAL AND PANNING WORK
- A. Fabricate and install all extruded aluminum and formed sheet aluminum brake-metal work in conjunction with the aluminum storefront work as detailed and as reasonably required to complete the work including sill extensions, snap trim pieces, jamb and sill trim, closures, coverings, flashings and other miscellaneous extruded and formed brake-metal work in conjunction with the Work of this Section.
 1. Provide extruded shapes wherever possible, reserving formed work for conditions where extrusions are not applicable.
 2. Provide sheet metal panning not less than 0.060 inch thick.
 3. Fasten trim clips, at not more than 16 inches on center.
 - B. Protect surfaces from marring when forming work. Provide sufficient material thickness with all necessary concealed reinforcement and anchorage to prevent "oil canning" or deformation of the finished work. Material deemed defective by the architect will be replaced at no cost to the Owner.
- 2.10 DOOR HARDWARE
- A. Hardware shall be furnished under Section 08 71 00 - DOOR HARDWARE, and installed by aluminum entrance and storefront framing system manufacturer, conforming to governing laws and building codes.
 1. Install all reinforcing required and prepare doors for finished hardware specified.
- 2.11 GLASS AND GLAZING MATERIALS
- A. Glazing materials, including all sealant, tapes and gaskets, shall be as recommended by the storefront/entrance system manufacturer, and shall be in strict accordance with the manufacturer's printed instructions. It shall be the responsibility of the aluminum system manufacturer to provide glazing materials which are appropriate for the various uses and conditions, compatible with each other and also compatible with the materials with which in contact.
 1. Continuous cushions beneath all glazing materials: Extruded dense EPDM rubber gaskets (60 +/- Shore A durometer), complying with ASTM C 864.

2. Continuous and recessed spacers: Extruded, closed-cell sponge neoprene or EPDM gaskets (40 +/- 5 Shore A durometer) complying with ASTM C 509.

2.12 SURFACE-APPLIED SAFETY/SECURITY GLAZING FILM

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on 3M Window Film, St. Paul, MN., product: "3M™ Scotchshield™ Safety and Security Window Film, Ultra S800."
 1. Surface-applied safety/security glazing film is an Awarding Authority's proprietary product: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the product(s) specified herein shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.
 2. Substitutions: The products specified herein establish standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - a. Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.
- B. Description: Optically clear polyester film, consisting of co-extruded micro-layers, with a durable acrylic abrasion resistant coating over one surface, and a UV stabilized pressure sensitive adhesive on the other. The film color is clear and will not contain dyed polyester.
 1. Thickness: 8 mils (0.008 inches).
 2. Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E-84:
 - a. Flame Spread Index (FDI): 5.
 - b. Smoke Developed Index (SDI): 25.
 3. Film properties:
 - a. Tensile Strength (ASTM D882):
 - 1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
 - 2) Coated Film: 27,000 psi (MD) / 27,000 psi (TD).
 - b. Break Strength (ASTM D882):
 - 1) Base Film: 190 lb/in (MD) / 190 lb/in (TD).

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- 2) Coated Film: 215 lb/in (MD) / 215 lb/in (TD).
 - c. Percent Elongation at Break (ASTM D882):
 - 1) Base Film: 110 % (MD) / 100% (TD).
 - 2) Coated Film: 95 % (MD) / 95% (TD).
 - d. Yield Strength at 3% Elongation:
 - 1) Base Film: 12,000 psi (MD).
 - 2) Coated Film: 15,000 psi (MD).
 - e. Percent Elongation at Yield (ASTM D882):
 - 1) Base Film: 7% (MD).
 - 2) Coated Film: 8% (MD).
 - f. Young's Modulus (ASTM D882):
 - 1) Base Film: 550 kpsi (MD) / 600 kpsi (TD).
 - 2) Coated Film: 550 kpsi (MD) / 600 kpsi (TD).
 - g. Graves Tear Resistance (ASTM D1004):
 - 1) Maximum Force (lbs):
 - a) Base Film: 40 (MD) / 40 (TD)
 - b) Coated Film: 40 (MD) / 40 (TD)
 - 2) Maximum Extension (in):
 - a) Base Film: 0.45 (MD) / 0.65 (TD)
 - b) Coated Film: 0.50 (MD) / 0.57 (TD)
 - 3) Graves Area Tear Resistance (lbs%):
 - a) Base Film: 1,100 (MD) / 1,300 (TD).
 - b) Coated Film: 1,100 (MD) / 1,300 (TD)
 - h. Puncture Propagation Tear Resistance (ASTM D2582):
 - 1) Coated Film: 9 lbf (MD) / 10 lbf (TD)
 4. Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
 5. Adhesion to Glass: The Manufacturer shall provide independent test data showing that the film shall have a 90-degree peel strength (adhesion to glass) according to ASTM D-1044 of at least 6 lbs/in.
 6. Impact Resistance for Safety Glazing: Manufacturer shall provide independent test data showing that the film, when applied to either side of the window glass, shall meet the 400 ft-lb impact requirements of 16 CFR 1201 (Category 2) and ANSI Z97.1 (Class A, Unlimited). Testing shall be done with film applied ¼ inch thick annealed glass.
 7. Windborne Debris Protection: pass ASTM E330 at a design pressure of 100 psf with 3M Impact Protection Adhesive attachment system
 8. Bomb Blast Mitigation: The Manufacturer shall provide independent test data showing the following:
 - a. GSA Rating of "2" (Minimal Hazard) / ASTM F1642 "No Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 3/8" tempered single pane glass and 3M Impact Protection Adhesive Attachment system
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- C. Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be essentially optically flat and shall meet the following criteria:

2.13 GLASS TYPES

- A. Glass Type GL-11: clear, Insulated "Low-E," glass, 1 inch thick with clear color exterior lite.
1. Basis of Design, Glass/Low-E Coating: Viracon VE1-85.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear colored glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 76 percent.
 - b. Solar Energy Transmittance: 47 percent.
 - c. UV Transmittance: 26 percent.
 - d. Reflectance Out: 12 percent
 - e. Solar Reflectance: 21 percent
 - f. U-value: 0.27 winter/0.24 summer.
 - g. Shading Coefficient: 0.63
 - h. Relative Heat Gain: 128 Btu/(hr x sqft)
 - i. Solar Heat Gain Coefficient: 0.54
 - j. Light to Solar Gain: 1.41
- B. Glass Type GL-11(A), clear: Insulated "Low-E," glass, 1 inch thick with Green color exterior lite.
1. Basis of Design, Glass/Low-E Coating: Viracon VE7-85.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, equal to Viracon "Azuria" colored glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.

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- c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 - 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 58 percent.
 - b. Solar Energy Transmittance: 24 percent.
 - c. UV Transmittance: 19 percent.
 - d. Reflectance Out: 12 percent
 - e. Solar Reflectance: 7 percent
 - f. U-value: 0.27 winter/0.24 summer.
 - g. Shading Coefficient: 0.35
 - h. Relative Heat Gain: 74 Btu/(hr x sqft)
 - i. Solar Heat Gain Coefficient: 0.31
 - j. Light to Solar Gain: 1.87
- C. Glass Type GL-11(B): Insulated "Low-E," glass, 1 inch thick with "Optiblu" color exterior lite.
- 1. Basis of Design, Glass/Low-E Coating: Viracon VE18-85.
 - 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, equal to Viracon "Azuria" colored glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 - 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 55 percent.
 - b. Solar Energy Transmittance: 37 percent.
 - c. UV Transmittance: 20 percent.
 - d. Reflectance Out: 12 percent
 - e. Solar Reflectance: 16 percent
 - f. U-value: 0.27 winter/0.24 summer.
 - g. Shading Coefficient: 0.52
 - h. Relative Heat Gain: 108 Btu/(hr x sqft)
 - i. Solar Heat Gain Coefficient: 0.46
 - j. Light to Solar Gain: 1.20

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- D. Glass Type GL-11(C): Insulated "Low-E," glass, 1 inch thick with Bronze color exterior lite.
1. Basis of Design, Glass/Low-E Coating: Viracon VE4-85.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, equal to Viracon "Bronze" colored glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 44 percent.
 - b. Solar Energy Transmittance: 28 percent.
 - c. UV Transmittance: 11 percent.
 - d. Reflectance Out: 11 percent
 - e. Solar Reflectance: 11 percent
 - f. U-value: 0.27 winter/0.24 summer.
 - g. Shading Coefficient: 0.42
 - h. Relative Heat Gain: 87 Btu/(hr x sqft)
 - i. Solar Heat Gain Coefficient: 0.36
 - j. Light to Solar Gain: 1.22
- E. Glass Type GL-12: Insulated "Low-E," glass, 1 inch thick
1. Basis of Design, Glass/Low-E Coating: Viracon VE1-53.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear glass, with Low-E coating on the number 2 surface.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 49 percent.
 - b. Solar Energy Transmittance: 18 percent.
 - c. UV Transmittance: 2 percent.
 - d. Reflectance Out: 19 percent

- e. Solar Reflectance: 36 percent
 - f. U-value: 0.24 winter/0.20 summer.
 - g. Shading Coefficient: 0.26
 - h. Relative Heat Gain: 54 Btu/(hr x sqft)
 - i. Solar Heat Gain Coefficient: 0.22
 - j. Light to Solar Gain: 2.23
- F. Glass Type GL-13: Insulated "Low-E," glass, 1-11/32 inch thick.
- 1. Basis of Design, Glass/Low-E Coating: Viracon VE1-85.
 - 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 19/32 inch (15mm), clear laminated security glass.
 - 1) Basis of Design: School Guard Glass, Adams MA. product SSG4, (Owner designated proprietary product).
 - a) Outer face: 1/4 inch (6 mm) thick heat strengthened clear glass.
 - b) Interlayer: School Guard Glass SSG4 proprietary interlayer.
 - c) Inner face: 1/4 inch (6 mm) thick heat strengthened clear glass.
 - 2) Glass Type GL-13 is an Awarding Authority's proprietary product: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the product(s) specified herein shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.
 - 3) Substitutions: The products specified herein establish standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - a) Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not

grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.

- c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
3. Performance Requirements: Glass shall be equal to or have better performance than Glass Type GL-11.
- G. Glass Type GL-14 - EXT: Insulated Translucent "Low-E," glass, Nominal 1-1/8 inch thick.
1. Basis of Design, Glass/Low-E Coating: Viracon VE1-85.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: Nominal 1/4 inch (6mm), laminated translucent glass.
 - 1) Outer face: 3/16 inch (3 mm) thick clear fully-tempered safety glass.
 - 2) Interlayer: 0.015 inch (0.38 mm) thick white pigmented inter-layer.
 - a) Basis of Design Pattern: Basis of Design: Eastman Chemical Company (Saflex Brand), St. Louis, MO., product "Vanceva Artic Snow."
 - 3) Inner face: 3/16 inch (3 mm) thick clear fully-tempered safety glass..
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
- H. Glass Type GL-15 (Vestibule doors): clear, Insulated "Low-E," glass, 1 inch thick with clear color exterior lite, with applied security film.
1. Basis of Design, Glass/Low-E Coating: Viracon VE1-85.
 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear colored glass, with Low-E coating on the number 2 surface.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass with applied security film.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 - e. Security Film is an Awarding Authority's proprietary product: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the product(s) specified herein shall be proprietary for 'sound reasons in the public interest'. This

determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.

- f. Substitutions: The products specified herein establish standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - 1) Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.
- 3. Performance Requirements: Glass shall be equal to or have better performance than Glass Type GL-11.
- I. Glass Type GL-16: clear, Insulated "Low-E," glass, 1 inch thick with light diffusing cavity with capillary slab encased in fiber tissue.
 - 1. Basis of Design, Glass: Okalux North America, LCC, product "Okalux+".
 - 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear glass, with Low-E coating on the number 2 surface, matching Glass Type GL11.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - b. Inner Layer: 1/4 inch (6mm), clear glass.
 - 1) Provide heat-strengthened glass except where fully-tempered safety glass is required by codes.
 - c. Air Space: 9/16" (14mm) overall with 5/16" (8 mm) gas filled cavity and 6mm PMMA acrylic UV stable capillary slab encased in fiber tissue. Capillaries are not to exceed 3 mm diameter to assure proper diffusion.
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.

3.2 SCHEDULE – SAFETY GLASS CRITERIA

- A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:
 - 1. Glazing in swinging doors except jalousies.
 - 2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
 - 3. Glazing in storm doors.

4. Glazing in unframed swinging doors.
5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.
10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

2.14 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
 1. Check dimensions of openings for entrance and storefront systems in the actual construction by accurate field measurement before fabrication. When necessary to proceed with the fabrication without field measurements, coordinate and control installation tolerances to ensure proper fit of the aluminum entrance and storefront systems.
- B. Factory / Shop Assembly: Before shipment, complete fabrication, assembly, finishing, hardware application, and other work to the greatest extent possible. Disassemble only for shipment and installation.

1. Do not use exposed fasteners. For hardware, use Phillips flat-head machine screws; match finish of member or hardware being fastened.
 2. Do not drill and tap for surface-mounted hardware until installation.
 3. Perform fabrication, including cutting, fitting, forming, drilling and grinding to prevent damage to exposed finish surfaces. For hardware, perform prior to application of finishes.
 4. Welding: Comply with AWS recommendations; grind exposed welds smooth and restore mechanical finish.
 5. Dissimilar Metals: Separate dissimilar metals with zinc chromate primer, bituminous paint, or other separator.
 6. Continuity: Maintain accurate relation of planes and angles, with hairline fit of contacting members.
- C. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings

2.15 FACTORY FINISHES

- A. Finish (frame components): Shop-applied, fully oven cured Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluropon Classic II."
 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.
- B. Finish (doors only with clear coat): Custom, shop-applied, fully oven cured Polyvinylidene Flouride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.75 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:
1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".

2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color with added clear top coat to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluoropon Classic II."
 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.
 6. Clear Protective Top Coat at entrance doors: Polyvinylidene flouride enamel clear top coat averaging 0.45 to 0.55 mils dry film thickness
- C. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- D. Isolation coating to cementitious and dissimilar materials: Apply one coat of bituminous paint or other acceptable coating to concealed aluminum surfaces in contact with cementitious and dissimilar materials

2.16 ACCESSORIES

- A. All anchors and fasteners, including screws, nuts, bolts, rivets, and other fastening devices shall be of tempered aluminum or non-magnetic type 302/304 stainless steel, warranted by the manufacturer to be non-corrosive and compatible with aluminum frame members. All such devices shall be of suitable type and adequate capacity for each intended purpose.
1. Finished aluminum work shall generally be without use of exposed fasteners. Provide exposed fasteners only where acceptable to Architect, finish to match surrounding aluminum.
- B. Sealant and backing materials.
1. Sealant used within system: As recommended by manufacturer.
 2. For all non-structural system sealant joints, including exterior metal-to-metal weather seals: Sealant type "SE" as specified under Section 07 92 00 - JOINT SEALANTS, or as otherwise recommended by manufacturer.
 3. For perimeter joints between system framing and abutting materials, including exterior metal-to-metal weather seals: Sealant type "SE" as specified under Section 07 92 00 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and

work are suitable to satisfactorily receive the work of this Section. Verify wall openings and adjoining air and vapor seal materials are ready to receive work of this Section. Notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1. Beginning of installation means acceptance of project conditions.

B. Evaluation and Assessment:

1. Verify that field measurements are as indicated on shop drawings.

3.2 ERECTION

A. Coordinate the installation of the entrance and storefront systems, and related items to be furnished hereunder with the work of the other trades responsible for providing receiving and interfacing materials, and ensure that all receiving and supporting surfaces have been completed and ready to receive the work of this Section.

B. Perform the installation work in strict accordance with the approved shop drawings, and the manufacturers' installation instructions, and the herein-referenced standards. Erect the various systems and items plumb and true, in proper alignment and relation to established lines and grades.

1. All shims shall be aluminum. Wood shims will not be acceptable.

2. Provide sheet aluminum closures as indicated or required to complete the Work.

3. Provide thermal isolation where components penetrate or disrupt building insulation.

4. Install flashings and set thresholds in bed of mastic and secure.

C. Install entrance / storefront doors and hardware in accordance with requirements of Section 08 05 13- COMMON WORK RESULTS – DOOR AND HARDWARE INSTALLATION, manufacturer's written instructions and as specified in this Section.

D. Perform all glazing work in accordance with GANA Glazing Manual and SIGMA standards, and with the entrance and storefronts framing system manufacturers' recommended glazing procedures.

1. All glass at entrance and storefront frames shall be set by use of resilient glazing gaskets between both interior and exterior stops and glass, weathertight, in strict accordance with the printed glazing instructions of the manufacturers of aluminum work and glazing materials.

2. Install security glass lites per manufacturer's written recommendations, including providing sealant required at glass lite perimeter.

E. Ensure that all metal-to-metal and metal-to-glass joints are completely weathertight, and that adequate provisions have been made to permit expansion and contraction in the metal.

F. Except as required by code, no permanent exposed to view labels of any kind will be permitted to remain on the doors, frames or glass.

3.3 TOLERANCES

- A. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities. Erect the aluminum entrance and storefront systems plumb and level, free of warp or twist.
 - 1. Install 1/16 inch per 10 feet, non cumulative, maximum variation from plumb.
 - 2. Install 1/32 inch maximum misalignment of two adjoining members abutting in plane.

3.4 ADJUSTING

- A. Adjust doors and hardware for smooth operation and tight fit. Lubricate hardware and other moving parts.
- B. Lubricate hardware and other moving parts.

3.5 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under the provisions of Section 01 43 25 - TESTING AGENCY SERVICES.
 - 1. Up to 4 units will be tested at the following stages of completion.
 - a. 25 Percent pf completion.
 - b. 50 Percent of completion.
 - c. 75 Percent of completion.
- B. Air and water performance criteria below applies to all built-in field testing of exterior enclosure components.
 - 1. Perform water spray testing prior to installation of interior finishes, and locate testes in areas designated by Architect.

Performance Criteria	
Air	Water
ASTM E 1186 (4.2.7) – No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s)	AAMA 501.2 No uncontrolled water leakage when tested by hose test, having nozzle not greater than 12 inches from surface, at 30 to 35 psi water pressure.
ASTM E 783 – Maximum air leakage of 0.09 cfm/ft at an air pressure differential of 6.24 psf	

- C. Water leakage is only acceptable if ALL of the following conditions are satisfied:
 - 1. Water is contained and positively drained to the exterior.
 - 2. There is no wetting of a surface that is visible to the building occupants.
 - 3. There is would be no staining or other damage to the completed building or finishes.
- D. Where testing indicates that performance requirements are not met, the contractor shall identify the leakage path through investigation and repair or replace the failed section and conduct a re-test. Sufficient notice shall be given to the Architect and

Owner of any investigations, repairs, or replacements to be conducted to allow observations by the Owner's Commissioning / Testing Agent. Re-testing shall be conducted by the Owner's Commissioning / Testing Agent. All costs associated with the repair and re-testing, including additional observations by the Owner's Commissioning / Testing Agent, shall be the responsibility of the contractor.

- E. In addition to re-testing, failed tests will typically result in testing of an additional specimen when available and at the discretion of the Owner and at the cost of the contractor. Additional specimen testing will be concluded only once satisfactory results are achieved on previously failed specimen.
- F. Maintain test log and submit report to Architect indicating tests, locations, dates, results, and remedial actions.

3.6 CLEANING

- A. Clean work under provisions of Section 01 74 23 – FINAL CLEANING.
 - 1. Clean storefront system promptly after installation, exercising care to avoid damage. Thoroughly clean all metal surfaces free from dirt, handling marks, packing tapes, and foreign matter; remove excess sealant.
 - 2. Remove labels from glass surfaces.
 - 3. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess sealing compounds, mortar, paint, dirt, and other contaminants.
 - a. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.
 - 1. The manufacturer shall advise the Contractor of protective treatment and other precautions required by him through the remainder of construction to ensure that the work of this Section will be without damage or deterioration at the time of Substantial Completion of the Contract.
- B. Repair Broken Glass:
 - 1. Replace in kind and thickness all glass breakage caused by the work performed under this Section, and bear all costs therefor.
 - 2. Replace in kind and thickness all glass breakage, caused by other trades, because of negligence or any other reasons, with the costs being borne by the trade at fault, or the Contractor, as applicable.

End of Section

Section 08 63 00
METAL-FRAMED SKYLIGHTS
(TRADE CONTRACT REQUIRED AS PART OF SECTION 08 00 05)

ADD SUPERSKY

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. PUBLICLY BID TRADE CONTRACT REQUIREMENTS: As provided under Section 08 00 05 – METAL WINDOWS TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 08 00 05 – METAL WINDOWS TRADE CONTRACT REQUIREMENTS.

1.2 SUMMARY

- A. Design, fabricate and erect metal framed extruded aluminum skylights including the following:
 - 1. Prefinished aluminum framed double-pitch ridge system, for locations indicated, including all required integral reinforcing, bracing members, flashing closure trim and related accessories for the framing systems.
 - a. Work includes internal gutter system.
 - 2. All glass and glazing materials.
 - 3. Sealant and backing materials.
- B. Furnish and maintain all staging, cranes, lifts and hoists required for the installation of the skylight components.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate 2, which affects the scope of work for this Section 08 63 00.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) "Silver" certification based on USGBC's LEED v4 BD+C. Certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Steel framing system and curb.
- E. Section 05 40 00 - COLD-FORMED METAL FRAMING: Light gage metal framing system.
- F. Section 05 50 00 - METAL FABRICATIONS: Support clips for skylight.

-
- G. Section 07 62 00 - SHEET METAL FLASHING AND TRIM: Curb flashing.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ANSI Z 97.1 - Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings.
 2. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 3. ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 4. ASTM A 36 - Structural Steel.
 5. ASTM B 209 - Aluminum and Aluminum-Alloy sheet and Plate.
 6. ASTM B 221 - Aluminum and Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
 7. ASTM C 1036 - Flat Glass.
 8. ASTM C 1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 9. ASTM E 546 - Test Method For Frost Point of Sealed Insulating Glass Units.
 10. ASTM E 576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
 11. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance.
 12. ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
 13. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 14. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
 15. FS TT-C-494 - Coating Compound, Bituminous, Solvent Type, Acid Resistant.
 16. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
 17. IGCC: Certified Products Directory, and Certification Guidelines.
 18. NFPA Publication 80 - Fire Doors and Windows.
 19. SGCC: Certified Products Directory, and Certification Guidelines.
 20. All applicable federal, state and municipal codes, laws and regulations for skylights and roofing materials.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. GANA Laminated Glazing Reference Manual (2009 edition).
 2. GANA - Glazing Manual (50th Anniversary edition).
 3. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
 4. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - a. Provide sealant technical data.
 - b. Provide glazing technical data.
 2. Test reports: Provide certified test reports, made by recognized independent testing organizations, shall verify that the skylight will meet the performance criteria as specified hereinafter.
 3. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
 4. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
 5. Review statement: Written statement, signed by the skylight installer, stating that the Contract Drawings have been reviewed by the skylight manufacturer; accompanied by a written statement from the manufacturer that the selected skylight system, is proper, compatible, and adequate for the application shown.
 6. Shop drawings: Include 1/4 inch scale elevations and plans of skylight. Include large scale design details showing attachment clips and brackets, expansion and contraction joint details, flashing details; weep and drainage details, and complete installation details, including field welding.
 - a. Drawings must bear seal and signature of same registered professional engineer licensed in the Commonwealth of Massachusetts responsible for calculations, and preparation of submittal.
 - b. Indicate framed opening requirements and tolerances; anchorage and fasteners; pane opening sizes; anticipated deflection under load; affected related work; expansion and contraction joint locations
 - c. Indicate component dimensions, connections and locations, anchorage, methods of joining, and details of all field connections.
 - d. Indicate material, metal thicknesses, metal finishes, glazing seals and sealant application, glass thickness, all surrounding conditions, and all pertinent information.
 - e. Provide plans, including spotting plans for preset inserts, elevations, sections, full size details and complete installation data.
 7. Selection samples:
 - a. Color samples of manufacturer's finish for aluminum for Architect's approval.
 8. Verification samples:
 - a. Three 12 inch long samples of each subordinate system components including curbs, mullions, closure caps, and miscellaneous aluminum trim components required for a complete installation.
 - b. 8 by 8 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.

9. Provide the following LEED submittal items:
 - a. All relevant supporting documentation, as required by LEED for Schools v4 and as detailed in Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
 - b. A completed LEED Materials Reporting Form, per Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.6 QUALITY ASSURANCE

- A. Installer specializing in applying the work of this Section with a minimum of 3 years experience and authorized by the product manufacturer.
- B. The skylight manufacturer shall have demonstrated proven experience in skylight work of similar size and complexity using similar types of skylight components. Manufacturer shall provide a list of references to the Architect of at least two projects that have been successfully in use for at least 5 years.
- C. The skylight manufacturer shall be a single source of responsibility for the specification, design, layout, fabrication and coordination of the components that constitute the complete skylight system.
- D. The manufacturer for the skylight framing systems shall employ the services of a qualified structural engineer, licensed to practice in the Commonwealth of Massachusetts, to prepare all calculations and other performance criteria for the respective systems, and bear all costs therefor. All shop drawings for the metal components of the respective systems shall bear the registration stamp of the engineer.
- E. Design, fabricate, assemble and erect the skylights, and their interfacing conditions with contiguous work, to ensure that all segments of the skylight assemblies will be free from leakage.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in a timely manner to maintain continuous erection. Provide wrapping to protect aluminum surfaces. Do not use adhesive papers which bond when exposed to sunlight or weather.
- B. Store all materials in an level-elevated location, protected from inclement weather and to allow examination by Architect. Store insulated skylight panels on the long edge, elevated above ground, blocked and under cover to prevent warping. Store in sequence to reduce handling so that materials are moved only during initial delivery to site and erection.

1.8 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.9 PROJECT CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.10 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Coordinate the work with the installation of structural steel framing, wood curbs and nailers, and roofing system.
- C. Coordinate this section with dimensions, tolerances, and method of attachment with other adjacent work.

1.11 WARRANTIES

- A. Provide the following warranties under under provisions of Section 01 77 00 - CLOSEOUT PROCEDURES
- B. Provide 10 year manufacturer's warranty for framing system which shall include repair or replacement of any system which leaks, or exhibits defects in materials workmanship, design, or erection.
- C. Provide 5 year manufacturer's warranty for aluminum finish system, which shall include material replacement of the finish system in locations which exhibit defects in materials or workmanship, including, but not necessarily limited to, loss of adhesion, blistering, pitting, and color fading.
- D. Provide manufacture's warranty for glass:
 - 1. Laminated glass (inner lite): Manufacturer's 5 year written guarantee covering against defects in materials and workmanship of laminated glass and replacement of the same.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of laminated glass units as evidenced by edge separation, delamination, or discoloration of inner layer.
 - 2. Insulating Glass (assembled lites): Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of Project Substantial Completion.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Super Sky Products, Enterprises, LLC., Mequon, WI., two-sided capped system.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Naturalite Inc. (Division of Oldcastle Glass Inc.), Terrell, TX.
 - 2. Super Sky Products, Enterprises, LLC., Mequon, WI.
 - 3. Traco Skytech Systems, Inc., Bloomsburg PA.
 - 4. Wasco Products, Inc., Commercial Division, Sanford ME.

2.2 PERFORMANCE REQUIREMENTS

- A. Details of metal framing members, indicated on the Contract Drawings, are set forth to establish the general design, only. Actual sizes and gauges of the members, and all supplementary components, shall be as determined by the manufacturer's structural engineer, as required to meet performance criteria specified herein and as required by the 2015 International Building Code with Massachusetts Building Code, Ninth Edition amendments.
- B. Design and size skylight system so that on the projected areas, the completed skylight will carry all component dead loads, plus a minimum 40 pounds per square foot vertical live loading caused by snow and hail. All load bearing members shall be capable of carrying a minimum of 300 pounds concentrated live load midspan with no permanent deformation or buckling of members or glazing panel breakage. Design system for 22-1/2 pounds per square foot uplift loading from pressure/suction of wind.
 - 1. Design and size skylight structural members to support fire suppression piping suspended from skylight ridge member at a deadload of 3.5 pounds per linear foot.
- C. Thermal performance, U-value: 0.27.
- D. Normal-to-plane deflection of members at maximum design load shall be limited to L/175 deflection of the span of member. Assume the required outward pressure to be the same value as the inward pressure. All aluminum framing members shall be designed to a safety factor of 1.65 in accordance with Aluminum Association standards.
- E. Parallel-to-glass deflection shall not be greater than 75 percent of glass edge clearances.
- F. Water Penetration: Design, fabricate, erect and glaze the skylight and its connection to other work so as to prevent water penetration.
 - 1. Water penetration is defined as the uncontrolled penetration of water (not including condensation) to the interior of the building through the skylight system.

- G. Movement: System to accommodate, without damage to system, components or deterioration of seals; movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; deflection of structural support framing.

2.3 FRAMING MATERIALS

- A. Extruded Aluminum:
 - 1. Provide tubular shapes and profiles of manufacturer's standard construction for members of the skylight system. Web and flange, and 'I-beam' systems are unacceptable.
 - 2. Provide thickness as necessary to comply with the structural loading requirements, wall thickness of supporting members shall not be less than 0.100 inch.
 - 3. Provide aluminum alloy and temper for each shape as recommended by the skylight manufacturer to comply with the requirements of performance, fabrication, application of finish and control of color.
- B. Brackets and reinforcements: Provide aluminum brackets and reinforcements as structurally required. Do not use steel.
- C. Internal Reinforcement: Steel sections, ASTM A36, shapes to suit mullion sections.

2.4 GLASS AND GLAZING MATERIALS

- A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
 - 1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
 - 2. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.
 - 3. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.
 - 4. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
- B. Glass Type GL-15 - EXT: Insulated "Low-E," glass, 1-5/16 inch thick
 - 1. Basis of Design, Low-E Coating: Guardian SN 54 (Guardian SuperNeutral 54).
 - 2. Components:
 - a. Outer layer: 1/4 inch (6mm) thick, clear fully tempered safety glass, with Low-E coating on the number 2 surface.
 - b. Inner layer: 9/16 inch (15mm) clear laminated glass consisting of:
 - 1) Outer face: 1/4 inch (6 mm) thick clear heat strengthened glass.
 - 2) Inner layer: 0.060 inch thick PVB.

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- 3) Inner face: 1/4 inch (6 mm) thick clear heat strengthened glass.
 - c. Air Space: 1/2 inch (13mm) thick
 - 1) Gas fill: 90% Argon/10% Air
 - d. Spacer: Stainless steel, in black or mil finish as selected by Architect.
 - 3. Performance Requirements: Glass shall be equal to or have better performance than the following:
 - a. Visible Light Transmittance: 00 percent
 - b. Solar Heat Gain Coefficient: 0.00
 - c. Reflectance Out: 00
 - d. Solar Reflectance: 00
 - e. U-value: 0.00
 - f. Shading Coefficient: 0.00
 - g. Relative Heat Gain: 00
 - h. Light to Solar Gain: 00
 - C. Glazing strips:
 - 1. Snap-in or slip-in extruded neoprene meeting or exceeding the following:
 - a. Hardness: (Shore A) 50 +/- durometer
 - b. Tensile Strength (min.) 2,000 psi
 - c. Elongation (min.) 450%
 - 2. All gasketing shall be shop installed in the frames.

2.5 SEALANT MATERIALS

- A. Sealant used within system: As recommended by manufacturer.
- B. Cap seal exterior lites (typical).

2.6 ACCESSORIES

- A. Fasteners:
 - 1. Fasteners used to for the attachment of the exterior and interior caps shall be Type 302/304 stainless steel with neoprene washers equal to material specified for glazing gaskets.
 - 2. Fasteners used for bolting aluminum extrusions and connecting members and for the attachment of the skylight to the supporting curbs shall be aluminum alloy 2024-T5 or Type 302/304 stainless steel.
 - 3. All fasteners shall be finished to match aluminum framing and members.
- B. Anchorage Devices: Type recommended by manufacturer, concealed wherever possible.
- C. Closures and flashing: Aluminum Sheet, minimum 0.040 inch thickness .
- D. Insulation: Glass fiber, stuffing type as specified in Section 07 21 00 - THERMAL INSULATION.

- E. Protective back coating: FS TT-C-494, bituminous.
- F. Touch-up primer for galvanized steel surfaces: Zinc rich type.

2.7 FABRICATION

- A. Rigidly fit and secure joints and corners with internal reinforcement. Make joints and connections flush, hairline, and weatherproof.
- B. Fitting and assembly of the work shall be done in the manufacturer's shop, to the greatest extent possible. Work which cannot be permanently shop assembled shall be completely assembled, marked and disassembled before shipment to the project site to assure proper assembly in the field.
- C. Shop weld aluminum by the heliar process; grind smooth exposed welds. Employ methods recommended by American Welding Society to avoid discoloration at welds and finish welds to closely match adjacent aluminum finishes.
- D. Fabricate components allowing for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly, yet enabling installation.
- E. Rafter bars shall be of extruded aluminum and designed for snap-in neoprene glazing gaskets. Rafter bars shall have the condensation gutters as a portion of the extrusions. Cross bar gutters shall set on top of and drain into rafter gutters. In line gutters or guttering systems requiring sealant are unacceptable.
- F. Maintain continuous air and vapor barrier throughout assembly, with the barrier plane aligned with inside pane of glazing continuing to a heel bead of glazing sealant.
- G. Drain water entering exterior joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior.
- H. Prepare components to receive anchor devices. Fabricate anchorage items.
- I. Arrange fasteners, attachments, and jointing to ensure concealment from view.
- J. Complete the shop cutting, fitting, forming, welding, drilling and grinding of all metal work prior to cleaning, finishing, treatment and application of coatings.
- K. Glaze by means of a continuous neoprene glazing strip applied above and below the glass. Continuous neoprene glazing strips and setting blocks at glass quarter points shall be used at the top flange of the extruded aluminum curb for proper glass bearing. A gasket washer shall be used beneath the heads of all fasteners at the exterior caps. Neoprene or polyvinyl chloride spacers shall be used at all extrusions for glass separation. At no point shall glass come in contact with metal parts of the skylight.

2.8 FACTORY FINISHING

- A. Finish (frame components): Shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat

system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:

1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluoropon Classic II."
 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.
- B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Install skylight in accordance with this Section 08 63 00, and the manufacturer's shop drawings, specifications and recommendations.
- B. Install skylights plumb, level and true to line. Align assembly free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- C. Provide method of attachment to structure to permit sufficient adjustment to accommodate construction tolerances and irregularities.
 1. Provide alignment attachments, shims, and anchors required to permanently fasten skylight system to building structure.
- D. Attach and seal to adjacent air and vapor barrier materials.
- E. Install sill flashings.

- F. Pack fibrous insulation in shim spaces at perimeter of assembly to ensure continuity of thermal barrier.
- G. Clean aluminum and glass surfaces during installation of components. Remove excess sealant compounds dirt and other substances.
- H. Install glass in accordance with manufacturer's requirements and requirements of this Section, where conflicts do occur the most stringent requirements shall apply.
- I. Install perimeter joint sealant and backing materials as specified herein, in accordance with Section 07 92 00 - JOINT SEALANTS.

3.3 FIELD TESTING:

- A. Indicate field testing for verification of conformance to project performance requirements for air infiltration and water penetration. Testing should be performed at intervals throughout construction. Standard test methods should include AAMA 501.2.
 - 1. During and after testing there shall be no visible water on interior of skylight, or signs of leakage.
- B. Installer responsible for engaging testing agent for any re-testing. All units experiencing failure are required to be re-tested.

3.4 TOLERANCES

- A. Maximum Variation from Plane: 1/8-inch every 3 feet maximum or 1/4-inch per 100 feet, whichever is less.
- B. Alignment of Two Adjoining Members Abutting in Plane: Within 0.015 inches .

3.5 CLEANING

- A. Protect finished metal surfaces from damage during shipping, storage, and erection. Remove protective material from prefinished aluminum surfaces at time of Final Cleaning.
- B. Remove excess sealant, dirt and other foreign substances. Wash down exposed surfaces; wipe surfaces clean.
- C. Clean and polish all glass surfaces.

End of Section

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes

- 1. Furnishing and installation of all mechanical and electrical finish hardware necessary for all doors, and hardware as specified herein and as enumerated in hardware sets and as indicated and required by actual conditions at the building. The hardware shall include the furnishing of all necessary screws, bolts, expansion shields, drop plates, and all other devices necessary for the proper application of the hardware.

B. Related Sections

- 1. Division 6 Section - Finish Carpentry
- 2. Division 8 Section - Hollow Metal Doors and Frames
- 3. Division 8 Section - Wood Doors
- 4. Division 8 Section - Aluminum Framed Storefronts
- 5. Division 8 Section - Glass and Glazing
- 6. Division 26 Section - Electrical
- 7. Division 27 Section - Communications
- 8. Division 28 Section - Electronic Security and Safety

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:

- 1. Windows
- 2. Cabinets of all kinds, including open wall shelving and locks.
- 3. Signage, except as noted.
- 4. Complete toilet accessories including coat hooks, unless note otherwise.

5. Overhead doors, unless noted otherwise.

1.03 REFERENCES

- A. Applicable state and local building codes and standards.
- B. FIRE/LIFE SAFETY
 1. NFPA - National Fire Protection Association
 - a. NFPA 70 – National Electric Code
 - b. NFPA 80 - Standard for Fire Doors and Fire Windows
 - c. NFPA 101 - Life Safety Code
 - d. NFPA 105 - Smoke and Draft Control Door Assemblies
- C. UL - Underwriters Laboratories
 1. UL 10B - Fire Test of Door Assemblies
 2. UL 10C - Positive Pressure Test of Fire Door Assemblies
 3. UL 1784 - Air Leakage Tests of Door Assemblies
 4. UL 305 - Panic Hardware
- D. Accessibility
 1. ADA - Americans with Disabilities Act.
 2. Massachusetts Architectural Access Board Regulation – 521 CMR.
- E. DHI - Door and Hardware Institute
 1. Sequence and Format for the Hardware Schedule
 2. Recommended Locations for Builders Hardware
- F. ANSI - American National Standards Institute
 1. ANSI/BHMA A156.1 - A156.29, and ANSI A156.31 - Standards for Hardware and Specialties

1.04 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 requirements. Advise architect within the submittal package of incompatibility or issues.
- B. Catalog Cuts: Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.

- C. Final Hardware Schedule Content: Submit schedule with hardware sets in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening. Include the following information:
1. Door Index; include door number, heading number, and Architects hardware set number.
 2. Opening Lock Function Spreadsheet; list locking device and function for each opening.
 3. Type, style, function, size, and finish of each hardware item.
 4. Name and manufacturer of each item.
 5. Fastenings and other pertinent information.
 6. Location of each hardware set cross-referenced to indications on Drawings.
 7. Explanation of all abbreviations, symbols, and codes contained in schedule.
 8. Mounting locations for hardware.
 9. Door and frame sizes and materials.
 10. Name and phone number for the local manufacturer's representative for each product.
 11. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and/or access control components). Operational description should include how the door will operate on egress, ingress, and/or fire/smoke alarm connection.
- D. Key Schedule: After a keying meeting between representatives of the Owner, Architect, hardware supplier, and, if requested, the representative for the lock manufacturer, provide a keying schedule, listing the levels of keying, as well as an explanation of the key system's function, the key symbols used, and the door numbers controlled. Utilize ANSI A156.28 "Recommended Practices for Keying Systems" as a guideline for nomenclature, definitions, and approach for selecting the optimal keying system.
- E. Samples: If requested by the Architect, submit production sample or sample installations as requested of each type of exposed hardware unit in the finish indicated, and tagged with a full description for coordination with the schedule.
1. Samples will be returned to the supplier in like-new condition. Units that are acceptable to the Architect may, after final check of operations, be incorporated into the Work, within limitations of key coordination requirements.
- F. Templates: After final approval of the hardware schedule, provide templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware.
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- G. Riser and Wiring Diagrams: After final approval of the hardware schedule, submit riser and wiring diagrams as required for the proper installation of complete electrical, electromechanical, and electromagnetic products.
- H. Operations and Maintenance Data: Provide in accordance with Division 1 and include the following:
1. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 2. Catalog pages for each product.
 3. Name, address, and phone number of local representative for each manufacturer.
 4. Parts list for each product.
 5. Copy of final approved hardware schedule, edited to reflect "As installed."
 6. Copy of final keying schedule.
 7. As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.
 8. One (1) complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
 9. Copy of warranties including appropriate reference numbers for manufacturers to identify the project.
- I. Certificates of Compliance: Upon request of Architect or Authority Having Jurisdiction certificates of compliance for fire-rated hardware and installation instructions shall be made available.

1.05 QUALITY ASSURANCE

- A. Substitutions: Products are to be those specified to ensure a uniform basis of acceptable materials. Requests for substitutions must be made in accordance with Division 1 requirements. If proposing a substitute product, submit product data for the proposed item with product data for the specified item and indicate basis for substitution and savings to be made. Provide sample if requested. Certain products have been selected for their unique characteristics and particular project suitability.
1. Items specified as "no substitute" shall be provided exactly as listed.
 2. Items listed with no substitute manufacturers listed have been requested by the Owner or Architect to match existing for continuity and/or future performance and maintenance standards or because there is no known equal product.
 3. If no other products are listed in a category, then "no substitute" is implied.
- B. Supplier Qualifications: A recognized architectural hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for

supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides a certified Architectural Hardware Consultant (AHC) available to the Owner, Architect, and Contractor, at reasonable times during the course of the Work for consultation.

- C. Single Source Responsibility: Obtain each type of hardware (latch and locksets, hinges, exit devices, closers) from a single manufacturer.
- D. Fire-Rated Openings: Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwrites Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to the authorities having jurisdiction for use on types and sizes of doors indicated in compliance with requirements of fire-rated door and door frame labels.
- E. Electronic Security Hardware: When electrified hardware is included in the hardware specification, the hardware supplier must employ an individual knowledgeable in electrified components and systems, who is capable of producing wiring diagrams and consulting as needed. Coordinate installation of the electronic security hardware with the Architect and electrical engineers and provide installation and technical data to the Architect and other related subcontractors. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Tag each item or package separately with identification related to the final hardware schedule, and include installation instructions with each item or package.
- B. Each article of hardware shall be individually packaged in manufacturer's original packaging.
- C. Contractor will provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- D. Items damaged in shipment shall be replaced promptly and with proper material and paid for by whomever did the damage or caused the damage to occur.
- E. Hardware shall be handled in a manner to avoid damage, marring, or scratching. Irregularities that occur to the hardware after it has been delivered to the Project shall be corrected, replaced, or repaired by the Contractor. Hardware shall be protected against malfunction due to paint, solvent, cleanser, or any chemical agent.
- F. No direct shipments will be allowed unless approved by the Contractor.

1.07 WARRANTY

- A. Provide manufacturer's warranties as specified in Division 1 and as follows:
 - 1. Closers: 30 years, except electronic closers, 2 years.
 - 2. Exit Devices: 3 years, except electrified devices, 1 year.

- 3. Locksets: 3 years, except electrified locksets, 1 year.
 - 4. Continuous Hinges: Lifetime warranty.
 - 5. Other hardware: 1 year.
- B. No liability is to be assumed where damage or faulty operation is due to improper installation, improper use, or abuse.
 - C. Products judged to be defective during the warranty period shall be replaced or repaired in accordance with the manufacturer's warranty, at no additional cost to the Owner.

1.08 MAINTENANCE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Approval of manufacturers other than those listed shall be in accordance with paragraph 1.05.A.
- B. Note that even though an acceptable substitute manufacturer may be listed, the product must provide all the functions and features of the specified product or it will not be approved.

Item	Scheduled Manufacturer	Acceptable Substitute
Hinges	Ives (IVE)	Hager, Stanley
Continuous Hinges	Ives (IVE)	Markar, Stanley
Electric Power Transfer	Von Duprin (VON)	Adams-Rite, Sargent
Flush Bolts & Coordinators	Ives (IVE)	Burns, Rockwood
Locksets & Deadlocks	Schlage (SCH)	Best, Sargent
Classroom Security Locks	Securitech Group (SGI)	No Substitute
Exit Devices	Von Duprin (VON)	Precision, Sargent
Power Supplies	Von Duprin (VON) Schlage Electronics (SCE)	Precision, Sargent
Door Closers	LCN (LCN)	Sargent, Dorma
Electro-Hydraulic Automatic Operators	LCN (LCN)	Besam, Norton
Electro-Mechanical Automatic Operators	LCN (LCN)	Besam, Horton
Door Trim	Ives (IVE)	Burns, Rockwood
Protection Plates	Ives (IVE)	Burns, Rockwood
Overhead Stops	Glynn-Johnson (GLY)	Rixson, Sargent
Stops & Holders	Ives (IVE)	Burns, Rockwood
Thresholds & Weatherstrip	Zero (ZER)	National Guard, Reese
Silencers	Ives (IVE)	Burns, Rockwood
Door Contacts	Schlage Electronics (SCE)	GE, Sargent

Cylinders & Keying	Schlage (SCH)	No Substitute
Key Cabinets	Telkee (TEL)	HPC, Lund

- C. Hand of Door: Drawings show direction of slide, swing, or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
- D. Where the hardware specified is not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having the same operation and quality as the type specified, subject to the Architect's approval.

2.02 MATERIALS

A. Fasteners

- 1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
- 2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
- 3. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent that no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Review door specification and advise Architect if thru-bolts are required.
- 4. Hardware shall be installed with the fasteners provided by the hardware manufacturer.

B. Hinges

- 1. Provide five-knuckle, ball bearing hinges of type, material, and height as outlined in the following guide for this specification:
 - a. 1-3/4 inch thick doors, up to and including 36 inches wide:
Exterior: standard weight, bronze/stainless steel, 4-1/2 inches high
Interior: standard weight, steel, 4-1/2 inches high
 - b. 1-3/4 inch thick doors over 36 inches wide:
Exterior: heavy weight, bronze/stainless steel, 5 inches high
Interior: heavy weight, steel, 5 inches high
 - c. 2 inches or thicker doors:
Exterior: heavy weight, bronze/stainless steel, 5 inches high
Interior: heavy weight, steel, 5 inches high
- 2. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
- 3. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

- a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
4. The width of hinges shall be 4-1/2 inches at 1-3/4 inch thick doors, and 5 inches at 2 inches or thicker doors. Adjust hinge width as required for door, frame, and/or wall conditions to allow proper degree of opening.
 5. Provide hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to the electrified locking component.
 6. Provide mortar guard for each electrified hinge specified, unless specified in hollow metal frame specification.
 7. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches or less in height. Provide one additional bearing hinge for each 30 inches of additional door height.
 8. Acceptable manufacturers and/or products: Ives 5BB series, Hager BB series, Stanley FBB Series.
- C. Continuous Hinges
1. Provide aluminum geared continuous hinges conforming to ANSI A156.25, Grade 2.
 2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with .25 inch diameter Teflon coated stainless steel hinge pin.
 3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
 4. Hinges shall be capable of supporting door weights up to 450 pounds, and shall be successfully tested for 1,500,000 cycles.
 5. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by a testing agency acceptable to the authority having jurisdiction.
 6. Provide aluminum geared continuous hinges with electrified option where specified. Provide with sufficient number and gage of concealed wires to accommodate electric function of specified hardware.
 7. Install hinges with fasteners supplied by manufacturer. Hole pattern shall be symmetrically patterned.
 8. Acceptable manufacturers and/or products: Ives, Markar, Stanley.

D. Electric Power Transfer

1. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.
2. Electric power transfer is to be located per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.
3. Acceptable manufacturers and/or products: Von Duprin, Adams Rite, Sargent.

E. Flush Bolts

1. Provide automatic and manual flush bolts with forged bronze face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. Top rods at manual flush bolts for doors over 90 inches in height shall be increased by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.
2. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

F. Coordinators

1. Provide a bar-type coordinating device, surface applied to the underside of the stop at the frame head where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors.
2. Provide a filler bar of the correct length for the unit to span the entire width of the opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.
3. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

G. Mortise Locks

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Lock case shall be multi-function and field reversible for handing without opening the case. Cylinders: Refer to 2.04 KEYING.
2. Provide locks with a standard 2-3/4 inches backset with a full 3/4 inch throw stainless steel mechanical anti-friction latchbolt. Deadbolt shall be a full 1 inch throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrical options as scheduled. Provide electrified locksets with micro switch (RX) option that monitors the retractor crank, and is actuated when rotation of the inside or outside lever rotates the retractor hub. Provide normally closed contacts or normally open contacts as required by security system.

5. Lever trim shall be solid brass, bronze, or stainless steel, cast or forged in the design specified, with wrought roses and external lever spring cages. Levers shall be thru-bolted to assure proper alignment, and shall have a 2-piece spindle.
 - a. Lever design shall be Schlage 06A.
 - b. Lever trim on the secure side of doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
6. Acceptable manufacturers and/or products: Schlage L9000 series, Best 45H series, Sargent 8200 series.

H. Mortise Locks

1. Provide mortise locks certified as ANSI A156.13, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Cylinders: Refer to 2.04 KEYING.
2. The lockset shall provide the classroom locking function via use of a cylinder from the interior or exterior, which shall render the exterior lever rigid and inoperable until such time as unlocked by key. The lockset body and trim shall accommodate an exterior mortise cylinder. The interior lever shall provide single motion exiting at all times.
3. Lock case shall be made of stainless steel. The lock face plate shall measure 1 1/4" wide by 8" tall and .075" thick. The face plate shall contain appropriate openings for the deadbolt and latchbolt.
4. Provide locks with a standard 2-3/4 inches backset with a full 3/4 inch throw. Deadbolt shall be 1" tall, fabricated of stainless steel and project a minimum of 1" from the lock body. Projection of the deadbolt shall also instantly lock the exterior lever.
5. Provide standard 4 7/8" strike.
6. A mechanical indicator, mounted on the interior escutcheon below the upper mounting screw, shall switch to red when deadbolt is projected. A transparent lens shall protect the indicator.
7. The exterior lever handle shall be fabricated of cast stainless steel and contain a slip-clutch apparatus which will lower or rise without retracting the latch if depressed without insertion of the key or electric release.
8. Acceptable manufacturers and/or products: Securitech Group QID series, No Substitute.

I. Deadbolts

1. Provide deadbolt series conforming to ANSI A156 and function as specified. Cylinders: Refer to 2.04 KEYING.

2. Provide deadbolts with a standard 2-3/4 inches backset. Provide 2-3/8 inches where noted or if door or frame detail requires. Deadbolt shall be a full 1 inch throw, constructed of steel alloy.
 3. Provide manufacturers standard strike.
 4. Acceptable manufacturers and/or products: Schlage B600 series, Best T series, Sargent 480 series.
- J. Exit Devices
1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit and/or Fire Exit Hardware. Cylinders: Refer to 2.04 KEYING.
 2. Exit devices shall be touchpad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to the standard architectural finishes to match the balance of the door hardware.
 3. Touchpad shall extend a minimum of one half of the door width. Touch-pad finish shall be compatible to exit device finish. Compression springs will be used in devices, latches, and outside trims or controls, tension springs also acceptable.
 4. Devices to incorporate a deadlatching feature for security and/or for future addition of alarm kits and/or other electrical requirements.
 5. Provide manufacturer's standard strikes.
 6. Provide exit devices cut to door width and height. Locate exit devices at a height recommended by the exit device manufacturer, allowable by governing building codes, and approved by the Architect.
 7. Mechanism case shall sit flush on the face of all flush doors, or spacers shall be furnished to fill gaps behind devices. Where glass trim or molding projects off the face of the door, provide glass bead kits.
 8. Non-fire-rated exit devices shall have cylinder dogging.
 9. Removable mullions shall be a 2 inches x 3 inches steel tube. Where scheduled, mullion shall be of a type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
 10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to a 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
 - a. Lever style will match the lever style of the locksets.
 - b. Lever trim on doors serving rooms considered by the authority having jurisdiction to be hazardous shall have a tactile warning.
 11. Exit devices for fire rated openings shall be UL labeled fire exit hardware.

12. Field drill weep holes per manufacturer's recommendation for exit devices used in full exterior application, highly corrosive areas, and where noted in the hardware sets.
13. Provide electrical options as scheduled.
14. Acceptable manufacturers and/or products: Von Duprin 98/35 series, Precision Apex series, Sargent 80 series with deadlatching.

K. Power Supplies

1. Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.
2. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.
3. Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed.
4. Provide a power supply, where specified, with the internal capability of charging optional sealed backup batteries 24 VDC, or as required, in addition to operating the DC load.
5. Provide a power supply complete requiring only 120VAC to the fused input and shall be supplied in an enclosure.
6. Provide a power supply with emergency release terminals, where required, that allow the release of all devices upon activation of the fire alarm system complete with fire alarm input for initiating "no delay" exiting mode.
7. Acceptable manufacturers and/or products: Von Duprin PS900 series, Precision ELR series, Sargent 3500 series, Schlage Electronics PS900 series.

L. Door Closers

1. Provide door closers certified to ANSI/BHMA A156.4 Grade 1 requirements by a BHMA certified independent testing laboratory. Closers shall be ISO 9000 certified. Units shall be stamped with date of manufacture code.
2. Door closers shall have fully hydraulic, full rack and pinion action with cast aluminum cylinder, and shall utilize full complement bearings at shaft. Cylinder body shall be 1-1/2 inch diameter, and double heat-treated pinion shall be 11/16 inch diameter.

3. Provide hydraulic fluid requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
 4. Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force as required by accessibility codes and standards. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed, and back check.
 5. Closers shall not incorporate Pressure Relief Valve (PRV) technology.
 6. Provide stick on templates, special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other finish hardware items interfering with closer mounting.
 7. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.
 8. Door closers meeting this specification: LCN 4050 series, Sargent 351 series factory assembled (without PRV), Dorma 8900 series.
- M. Electro-Hydraulic Automatic Operators
1. Provide low energy automatic operator units with hydraulic closer complying with ANSI A156.19 where automatic operators are specified.
 2. Provide hydraulic fluid of a type requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F. Fluid shall be fireproof and shall pass the requirements of the UL10C "positive pressure" fire test.
 3. Provide units with conventional door closer opening and closing forces unless the power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
 4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
 5. Provide units with conventional door closer opening and closing forces unless the power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
 6. Provide drop plates, brackets, or adapters for arms as required for details.
 7. Provide hard-wired actuator switches for operation as specified. Actuators shall be weather-resistant type at exterior applications.
 8. Provide key switches, with LED's, recommended and approved by the manufacturer of the automatic operator as required for the function as described in the operation

description of the hardware group with the provisions below. Cylinders: Refer to 2.04 KEYING.

9. Where automatic operators are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by the manufacturer of the automatic operator for each individual leaf. Actuators shall control both doors simultaneously at pairs. Exterior and vestibule doors with automatic operators shall be sequenced to allow ingress or egress through both sets of openings as directed by the Architect. Locate the actuators, key switches, and other controls as directed by the Architect.
10. Provide units with vestibule inputs, which allow sequencing operation of two units, and a SPDT relay for interfacing with latching or locking devices.
11. Acceptable manufacturers and/or products: LCN 4600 series, Norton 6900 series, Besam Power Swing.

N. Electro-Mechanical Automatic Operators

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI A156.19 where automatic operators are specified.
2. The operator shall be powered with a DC motor working through reduction gears. Closing shall be spring force. No manual, hydraulic, or chain drive closer will be acceptable. The motor is to be off when the door is in closing mode. The door can be manually operated with the power on or off without damage to the operator. The operator shall include variable adjustments, including opening and closing speed adjustment. Operator shall be mounted in an aluminum cover.
3. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.
4. Provide drop plates, brackets, or adapters for arms as required to suit details.
5. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Actuators shall be weather-resistant type at exterior applications.
6. Provide key switches, with LED's, recommended and approved by the manufacturer of the automatic operator as required for the function as described in the operation description of the hardware sets. Cylinders: Refer to 2.04 KEYING.
7. Where automatic operators are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by the manufacturer of the automatic operator for each individual leaf. Actuators shall control both doors simultaneously at pairs. Exterior and vestibule doors with automatic operators shall be sequenced to allow ingress or egress through both sets of openings as directed by the Architect. Locate the actuators, key switches, and other controls as directed by the Architect.

8. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, a presence detector input, which prevents a closed door from opening or a door that is fully opened from closing, a hold open toggle input, which allows remote activation for indefinite hold open and close the second time the input is activated, vestibule inputs, which allow sequencing operation of two units, and a SPDT relay for interfacing with latching or locking devices.
9. Acceptable manufacturers and/or products: LCN Senior Swing, Besam Swingmaster MP, Horton 4000LE series.

O. Door Trim

1. Provide push plates 4 inches wide x 16 inches high x 0.050 inch thick and beveled 4 edges. Where width of door stile prevents use of 4 inches wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Push bars shall be of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as specified. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

P. Protection Plates

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch thick as scheduled. Furnish with machine or wood screws, finished to match plates. Sizes of plates shall be as follows:
 - a. Kick Plates – 10 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
 - b. Mop Plates – 4 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
 - c. Armor Plates – 34 inches high x 2 inches less width of door on single doors, 1 inch less width of door on pairs
2. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.

Q. Overhead Stops and Overhead Stop/holders

1. Provide heavy duty concealed mounted overhead stop or overhead stop/holder as specified for exterior and interior vestibule single acting doors.

2. Provide heavy or medium duty and concealed or surface mounted overhead stop or overhead stop/holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking a wall, open against equipment, casework, sidelights, and/or where conditions do not allow a wall stop or a floor stop presents a tripping hazard.
 3. Where overhead holders are specified provide friction type at doors without a closer and positive type at doors with a closer.
 4. Acceptable manufacturers and/or products: Glynn-Johnson, Rixson, Sargent.
- R. Door Stops and Holders
1. Provide door stops for all doors in accordance with the following requirements:
 - a. Provide dome type floor stops of proper height wherever possible.
 - b. Where floor stops cannot be used, provide convex type wall stops.
 - c. At any opening where a floor or wall stop cannot be used, a medium duty surface mounted overhead stop shall be used.
 2. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.
- S. Thresholds, Seals, Door Sweeps, Automatic Door Bottoms, and Gasketing
1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items as closely as possible. Size of thresholds shall be as follows:
 - a. Exterior Saddle Thresholds – 1/2 inch high x jamb width x door width
 - b. Interior Saddle Thresholds – 1/4 inch high x jamb width x door width
 - c. Bumper Seal Thresholds – 1/2 inch high x 5 inches wide x door width
 2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
 3. Acceptable manufacturers and/or products: Zero, Reese, National Guard.
- T. Silencers
1. Provide "Push-in" type silencers for each hollow metal or wood frame. Provide three for each single frame and two for each pair frame. Omit where gasketing is specified or required by code.
 2. Acceptable manufacturers and/or products: Ives, Burns, Rockwood.
- U. Door Contacts
1. Provide recessed or surface mounted type door position switches as specified.

2. Switches shall be installed as recommended by manufacturers installation instructions and coordinated with other hardware being installed on the opening. Coordinate door and frame preparations with door and frame suppliers. If separate switches are being used with a magnetic locking device provide a minimum of 4 inches between the switch and the magnetic locking device.
3. Acceptable manufacturers and/or products: Schlage Electronics, GE-Interlogix, Sargent.

2.03 FINISHES

- A. Finish of all hardware shall be US4 (BHMA 606/633) with the exceptions as follows:
 1. Continuous Hinges: Dark Bronze Aluminum.
 2. Overhead Stops and Holders (Exterior Doors): US4 (BHMA 606).
 3. Overhead Stops and Holders (Interior Doors): Powder Coat to Match.
 4. Door Closers: Powder Coat to Match.
 5. Weatherstripping: Gold.
 6. Thresholds: Golf Aluminum.

2.04 KEYING

- A. Provide cores and cylinders for the Owner's Existing Schlage key system conforming to the following requirements:
 1. Provide removable core cylinders at all exterior keyed devices, locksets, cylinder dogging, and exit device trim. Provide construction cores with construction master keying for use during construction. The Owner or Owner's Representative shall replace temporary construction cores with permanent cores upon completion of the project. The temporary construction cores are to be returned to the hardware supplier.
 2. Provide permanent cores and cylinders keyed by the manufacturer or authorized distributor into the existing key system as directed by the Owner. Provide owner with a copy of the bitting list, return receipt requested.
 3. The hardware supplier, accompanied by a qualified factory representative for the manufacturer of the cores and cylinders, shall meet with Owner and Architect to review keying requirements and lock functions prior to ordering finish hardware. Submit a keying schedule to Architect for approval.
 4. Provide keys as follows
 - a. Ten master keys for each set.
 - b. Three keys per core and/or cylinder.
 - c. Two construction core control keys
 - d. Two permanent core control keys

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- e. Six construction master keys for each type (Contractor is to provide one set of construction keys to Architect)
5. Visual key control:
- a. Keys shall be stamped with their respective key set number and stamped "DO NOT DUPLICATE".
 - b. All keys shall be stamped with their respective key set letters.
 - c. Do not stamp any keys with the factory key change number.
 - d. Do not stamp any cores with key set on face (front) of Core. Stamp on back or side of cores so not to be visible when core is in cylinder.
6. Deliver all keys and/or key blanks from the factory or authorized distributor directly to the Owner in sealed containers, return receipt requested. Failure to comply with these requirements may be cause to require replacement of all or any part of the keying system that was compromised at no additional cost to the Owner.
7. Approved products: Schlage Classic Keyways C, E, EF and F, No Substitute.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of any hardware, examine all doors, frames, walls and related items for conditions that would prevent proper installation of finish hardware. Correct all defects prior to proceeding with installation.

3.02 INSTALLATION

- A. Coordination:
 - 1. Prior to installation of hardware, schedule and hold a meeting for the purpose of instructing installers on proper installation and adjustment of finish hardware. Representatives of locks, exit devices, closers, automatic operators, and electrified hardware shall conduct training; provide at least 10 days notice to representatives. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.
 - 2. Prior to ordering electrified hardware, schedule and hold a meeting for the purpose of coordinating finish hardware with security, electrical, doors and frames, and other related suppliers. A representative of the supplier of finish hardware, and doors and frames, the electrical subcontractor, and the Owner's security contractor shall meet with the Owner, Architect, and General Contractor prior to ordering finish hardware. After meeting a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.
- B. Hardware will be installed by qualified tradesmen, skilled in the application of commercial grade hardware. For technical assistance if necessary, installers may contact the manufacturer's rep for the item in question, as listed in the hardware schedule.
- C. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

- D. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- E. Install perimeter gasketing to achieve a light-tight seal at the full perimeter of all gasketed doors.
- F. Do not install surface mounted items until finishes have been completed on the substrate. Protect all installed hardware during painting.
- G. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- H. Operating parts shall move freely and smoothly without binding, sticking, or excessive clearance.
- I. Wire (including low voltage), conduit, junction boxes, and pulling of wire is by Division 26, Electrical. Electrical Contractor shall connect wire to door position switches and run wire to central room or area as directed by the Architect. Wires shall be tested and labeled with the Architects opening number. Connections to/from power supplies to electrified hardware and any connection to fire/smoke alarm system, and/or smoke evacuation system where specified is by Division 26 Electrical.

3.03 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door, to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.
- B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Instruct Owner's personnel in the proper adjustment, lubrication, and maintenance of door hardware and hardware finishes.

3.04 FIELD QUALITY CONTROL

- A. Prior to Substantial Completion, the installer, accompanied by representatives of the manufacturers of locks, exit devices, closer, and any electrified hardware, shall perform the following work:
 - 1. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
 - 2. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.

3. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
4. Prepare a written report of current and predictable problems of substantial nature in the performance of the hardware.
5. At completion of project, a qualified factory representative for the manufacturers of locksets, closer, exit devices, and access control products shall arrange and hold a training session to instruct the Owner's personnel on the proper maintenance, adjustment, and/or operation of their respective products. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Architect.

3.05 PROTECTION

- A. Provide for the proper protection of complete items of hardware until the Owner accepts the project as complete. Damaged or disfigured hardware shall be replaced or repaired by the responsible party.

3.06 HARDWARE SCHEDULE

- A. Provide hardware for each door to comply with requirements of Section "Finish Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
- B. It is intended that the following schedule includes complete items of finish hardware necessary to complete the work. If a discrepancy is found in the schedule, such as a missing item, improper hardware for a frame, door or fire codes, the preamble will be the deciding document.
- C. Locksets, exit devices, and other hardware items are referenced in the Hardware Sets for series, type, and function. Refer to the preamble for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets

HEADING # 01 - (EXTERIOR ALUMINUM SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	DRIP CAP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 02 - (EXTERIOR ALUMINUM SINGLE WITH ELECTRIC RIM PANIC HARDWARE X AUTOMATIC OPERATOR)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	9540 SERIES (PUSH SIDE MOUNTED)	ANDKB	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY (UNINTERRUPTED)	FURNISHED BY OTHERS		
1	EA	POWER SUPPLY	PS902 900-2RS		VON

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY ONLY. REMOTE DOOR LOCK/UNLOCK BY ACCESS CONTROL SYSTEM. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: DOOR TO BE PART OF SMOKE CONTROL SYSTEM. UPON INITIATION OF SMOKE EXHAUST SEQUENCE FIRE ALARM INPUT, THE EXIT DEVICE LATCHBOLT SHALL RELEASE AND THE DOOR SHALL AUTOMATICALLY OPEN AND WHEN FULLY OPEN PROVIDE OPEN POSITION INDICATION TO THE FIRE ALARM SYSTEM. UPON ARRIVAL OF THE FIRE DEPARTMENT VIA HOA SWITCH AT THE SMOKE CONTROL PANEL MANUAL CONTROL OF THE DOORS WILL BE PROVIDED.

HEADING # 03 - (EXTERIOR ALUMINUM SINGLE WITH ELECTRIC RIM PANIC HARDWARE X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 04 - (EXTERIOR ALUMINUM SINGLE WITH ELECTRIC RIM PANIC HARDWARE X AUTO OPERATOR X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	4640 SERIES (PUSH SIDE MOUNTED)	696	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-855 (VESTIBULE)	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 05 - (EXTERIOR ALUMINUM SINGLE RIM PANIC HARDWARE)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	112HD	313AN	IVE
1 EA	PANIC HARDWARE	LD-98-NL-OP	606	VON
1 EA	RIM CYLINDER	AS REQUIRED	606	SCH
1 EA	OFFSET DOOR PULL	8190-0	606	IVE
1 EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1 SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1 EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1 EA	DRIP CAP	BY ALUMINUM DOOR SUPPLIER		
1 EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
1 EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 06 - (EXTERIOR SINGLE WITH STOREROOM LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1 EA	CONT. HINGE	112HD	313AN	IVE
1 EA	STOREROOM LOCK	L9080 06A	606	SCH
1 EA	SURFACE CLOSER	4050 SCUSH	696	LCN

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	GASKETING	429	G	ZER
1	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.
 OPERATIONAL DESCRIPTION:
 DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: LOCKSET TO BE LOCKED FROM INSIDE VESTIBULE TO ALLOW FREE EGRESS FROM ROOF.

HEADING # 07 - (EXTERIOR SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	GASKETING	429	G	ZER
1	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.
 OPERATIONAL DESCRIPTION:
 IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 08 - (EXTERIOR SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	GASKETING	429	G	ZER
1	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: LOCKSET TO BE LOCKED FROM INSIDE STAIR TO ALLOW FREE EGRESS FROM ROOF.

HEADING # 09 - (EXTERIOR SINGLE WITH ELECTRIFIED RIM PANIC HARDWARE X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	OFFSET DOOR PULL	8190-0	606	IVE
1	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	GASKETING	429	G	ZER
1	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 10 - (EXTERIOR SINGLE WITH RIM PANIC HARDWARE)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	313AN	IVE
1	EA	PANIC HARDWARE	CD-98-NL-OP	606	VON
1	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	OFFSET DOOR PULL	8190-0	606	IVE
1	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	GASKETING	429	G	ZER
1	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 11 - (EXTERIOR ALUMINUM PAIR WITH CONCEALED VERTICAL ROD PANIC HARDWARE)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	313AN	IVE
1	EA	PANIC HARDWARE	CD-9847-EO	606	VON
1	EA	PANIC HARDWARE	CD-9847-NL-OP	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 12 - (EXTERIOR ALUMINUM PAIR WITH CONCEALED VERTICAL ROD PANIC HARDWARE)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	313AN	IVE
1	EA	PANIC HARDWARE	CD-9847-EO	606	VON
1	EA	PANIC HARDWARE	CD-9847-NL-OP	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	OFFSET DOOR PULL	8190-0	606	IVE
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 13 - (EXTERIOR ALUMINUM PAIR WITH ELECTRIC CONCEALED VERTICAL
 ROD PANIC HARDWARE X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD
 READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO
 EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 14 - (EXTERIOR ALUMINUM PAIR WITH ELECTRIC CONCEALED VERTICAL ROD PANIC HARDWARE X AUTO OPERATOR X CARD READER X INTERCOM)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	9550 SERIES (PUSH SIDE MOUNTED)	ANDKB	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY (UNINTERRUPTED)	FURNISHED BY OTHERS		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CCTV INTERCOM	SPECIFIED ELSEWHERE		
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY, CARD READER, OR BY INTERCOM. CARD READER OR INTERCOM WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: DOOR TO BE PART OF SMOKE CONTROL SYSTEM. UPON INITIATION OF SMOKE EXHAUST SEQUENCE FIRE ALARM INPUT, THE EXIT DEVICE LATCHBOLT SHALL RELEASE AND THE DOOR SHALL AUTOMATICALLY OPEN AND WHEN FULLY OPEN PROVIDE OPEN POSITION INDICATION TO THE FIRE ALARM SYSTEM. UPON ARRIVAL

OF THE FIRE DEPARTMENT VIA HOA SWITCH AT THE SMOKE CONTROL PANEL MANUAL CONTROL OF THE DOORS WILL BE PROVIDED.

HEADING # 15 - (EXTERIOR ALUMINUM PAIR WITH ELECTRIC CONCEALED VERTICAL ROD PANIC HARDWARE)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR SWEEP	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY ONLY. REMOTE DOOR LOCK/UNLOCK BY ACCESS CONTROL SYSTEM. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 16 - (EXTERIOR PAIR WITH STOREROOM LOCKSET X FLUSH BOLTS X CLOSER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	313AN	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
2	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	429	G	ZER
2	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.
OPERATIONAL DESCRIPTION:
DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 17 - (EXTERIOR PAIR WITH FAIL SECURE ELECTRIFIED STOREROOM
LOCKSET X FLUSH BOLTS X CLOSER X CARD READER & INTERCOM)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	313AN	IVE
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
2	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	429	G	ZER
2	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CCTV INTERCOM	SPECIFIED ELSEWHERE		
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.
OPERATIONAL DESCRIPTION:
IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY, CARD READER OR BY
INTERCOM. CARD READER OR INTERCOM WILL UNLOCK LOCKSET AND ALLOW
ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S
SECURITY SYSTEM.

HEADING # 18 - (EXTERIOR PAIR WITH CONCEALED PANIC HARDWARE)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	313AN	IVE
1	EA	PANIC HARDWARE	CD-9847-EO	606	VON
1	EA	PANIC HARDWARE	CD-9847-NL-OP	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	OFFSET DOOR PULL	8190-0	606	IVE
2	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	ASTRAGAL	328 X 2 PC	G	ZER

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	GASKETING	429	G	ZER
2	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 19 - (EXTERIOR PAIR WITH ELECTRIFIED CONCEALED PANIC HARDWARE X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	OFFSET DOOR PULL	8190-0	606	IVE
2	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
1	EA	DRIP CAP	142	G	ZER
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	429	G	ZER
2	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	8655G (VERIFY JAMB DEPTH)	G	ZER
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 20 - (ALUMINUM SINGLE VESTIBULE WITH ELECTRIC RIM PANIC HARDWARE X AUTO OPERATOR X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	9540 SERIES (PUSH SIDE MOUNTED)	ANDKB	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY (UNINTERRUPTED)	FURNISHED BY OTHERS		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED.

DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: DOOR TO BE PART OF SMOKE CONTROL SYSTEM. UPON INITIATION OF SMOKE EXHAUST SEQUENCE FIRE ALARM INPUT, THE EXIT DEVICE LATCHBOLT SHALL RELEASE AND THE DOOR SHALL AUTOMATICALLY OPEN AND WHEN FULLY OPEN PROVIDE OPEN POSITION INDICATION TO THE FIRE ALARM SYSTEM. UPON ARRIVAL OF THE FIRE DEPARTMENT VIA HOA SWITCH AT THE SMOKE CONTROL PANEL MANUAL CONTROL OF THE DOORS WILL BE PROVIDED.

HEADING # 21 - (ALUMINUM SINGLE VESTIBULE WITH ELECTRIC RIM PANIC HARDWARE X AUTO OPERATOR X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	313AN	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-98-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
1	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	4640 SERIES (PUSH SIDE MOUNTED)	696	LCN
1	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 22 - (ALUMINUM PAIR VESTIBULE WITH ELECTRIC CONCEALED VERTICAL ROD PANIC HARDWARE X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 23 - (ALUMINUM PAIR VESTIBULE WITH ELECTRIC CONCEALED VERTICAL ROD PANIC HARDWARE X AUTO OPERATOR X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	EA	SURF. AUTO OPERATOR	4640 SERIES (PUSH SIDE MOUNTED)	696	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 24 - (ALUMINUM PAIR VESTIBULE WITH ELECTRIC CONCEALED VERTICAL ROD PANIC HARDWARE X AUTO OPERATOR X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	313AN	IVE
2	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-EO	606	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-9847-NL-OP	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	CUSTOM OFFSET PULL	RM3310 X 48"	606	ROC
2	EA	OVERHEAD STOP	CONCEALED HEAVY DUTY 100S SERIES	606	GLY
1	EA	SURF. AUTO OPERATOR	9550 SERIES (PUSH SIDE MOUNTED)	ANDKB	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T/8310-818T AS REQUIRED	630	LCN
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY (UNINTERRUPTED)	FURNISHED BY OTHERS		
1	EA	POWER SUPPLY	PS902 900-2RS		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. DOOR CAN BE MANUALLY OR AUTOMATICALLY OPERATED. ACCESS CONTROL SYSTEM TO RETRACT AND HOLD EXIT DEVICE LATCHBOLT AND ENABLE EXTERIOR AUTOMATIC OPERATOR ACTUATOR. DOOR CAN BE MANUALLY PULLED OPEN OR AUTOMATICALLY OPERATED BY PUSHING ACTUATOR WHICH SIGNALS AUTOMATIC OPERATOR TO OPEN DOOR. INTERIOR ACTUATOR TO SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. LOCATE ACTUATORS AS DIRECTED BY ARCHITECT.

SECURE OPERATION:

ACCESS CONTROL SYSTEM TO RELEASE EXIT DEVICE LATCHBOLT AND TAKE CONTROL OF EXTERIOR ACTUATOR TO CONTROL ENTRY. IMMEDIATE EGRESS ALWAYS ALLOWED. AUTOMATIC OPERATION BY PUSHING INTERIOR ACTUATOR WHICH WILL RETRACT EXIT DEVICE LATCHBOLT THEN SIGNAL AUTOMATIC OPERATOR TO OPEN DOOR. ACCESS BY KEY OR BY CARD READER. CARD READER WILL RETRACT EXIT DEVICE LATCHBOLT AND ALLOW ACCESS, AND TEMPORARILY ENABLE EXTERIOR ACTUATOR TO ALLOW AUTOMATIC OPERATION. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

NOTE: DOOR TO BE PART OF SMOKE CONTROL SYSTEM. UPON INITIATION OF SMOKE EXHAUST SEQUENCE FIRE ALARM INPUT, THE EXIT DEVICE LATCHBOLT SHALL RELEASE AND THE DOOR SHALL AUTOMATICALLY OPEN AND WHEN FULLY OPEN PROVIDE OPEN POSITION INDICATION TO THE FIRE ALARM SYSTEM. UPON ARRIVAL OF THE FIRE DEPARTMENT VIA HOA SWITCH AT THE SMOKE CONTROL PANEL MANUAL CONTROL OF THE DOORS WILL BE PROVIDED.

HEADING # 25 - (SINGLE WITH PUSH/PULL X DEADBOLT)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM DEADBOLT	B663	606	SCH
1	EA	CYLINDER PULL	1874	606	DON
1	EA	DOOR PULL	8103EZ -0	606	IVE
1	EA	PUSH PLATE	8200	606	IVE
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 26 - (SINGLE WITH PUSH/PULL X DEADBOLT)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM DEADBOLT	B663	606	SCH
1	EA	CYLINDER PULL	1874	606	DON
1	EA	DOOR PULL	8103EZ -0	606	IVE
1	EA	PUSH PLATE	8200	606	IVE
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	ROLLER BUMPER	RB472	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 27 - (SINGLE WITH OFFICE LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: ONLY 3 HINGES REQUIRED @ DOORS 7'6" TALL OR SHORTER.

HEADING # 28 - (SINGLE WITH OFFICE LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
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QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	THRESHOLD	64G	G	ZER
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 29 - (SINGLE WITH OFFICE LOCKSET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	870	G	ZER
1	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 30 - (SINGLE WITH CLASSROOM LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM LOCK	L9070 06A	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	THRESHOLD	64G	G	ZER
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 31 - (SINGLE - ALUMINUM - WITH CLASSROOM LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM LOCK	L9070 06A	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	SET	SEALS	BY ALUMINUM DOOR SUPPLIER		
1	EA	THRESHOLD	64G	G	ZER

HEADING # 32 - (SINGLE WITH CLASSROOM LOCKSET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CLASSROOM LOCK	L9070 06A	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	870	G	ZER
1	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 33 - (SINGLE WITH CLASSROOM SECURITY LOCKSET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM SECURITY LOCK	QID-M-N-1	606	SGI
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	870	G	ZER
1	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 34 - (SINGLE WITH CLASSROOM SECURITY LOCKSET X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM SECURITY LOCK	QID-M-N-1	606	SGI
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	870	G	ZER
1	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

NOTE: EACH DOOR NUMBER INCLUDES (2) DOOR LEAFS WITH A CLASSROOM SECURITY LOCKSET ON EACH LEAF TO CONTROL ENTRY FROM EACH SIDE. PUSHBUTTON TO BE ON PULL SIDE, KEYED CYLINDER TO BE ON PUSH SIDE.

HEADING # 35 - (SINGLE WITH STOREROOM LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: ONLY 3 HINGES REQUIRED @ DOORS 7'6" TALL OR SHORTER.

HEADING # 36 - (SINGLE WITH STOREROOM LOCKSET)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	OH STOP	450S	SP4	GLY
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 37 - (SINGLE WITH PRIVACY SET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	PRIVACY LOCK	L9040 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 38 - (SINGLE WITH OFFICE LOCKSET W/ INDICATOR X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE LOCK W/ OUTSIDE INDICATOR	L9056 06A L583-363 L283-722	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: ONLY 3 HINGES REQUIRED @ DOORS 7'6" TALL OR SHORTER.

HEADING # 39 - (SINGLE WITH OFFICE LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 40 - (SINGLE WITH OFFICE LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER

HEADING # 41 - (SINGLE WITH OFFICE LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 42 - (SINGLE WITH CLASSROOM LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM LOCK	L9070 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 43 - (SINGLE WITH CLASSROOM SECURITY LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CLASSROOM SECURITY LOCK	QID-M-N-1	606	SGI
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	THRESHOLD	64G	G	ZER
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 44 - (SINGLE WITH CLASSROOM SECURITY LOCKSET X CLOSER X SOUND GASKETING)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	CLASSROOM SECURITY LOCK	QID-M-N-1	606	SGI
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	870	G	ZER
1	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 45 - (SINGLE WITH STOREROOM LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE

HEADING # 46 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 47 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	THRESHOLD	64G	G	ZER
3	EA	SILENCER	SR64	GRY	IVE
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 48 - (SINGLE WITH STOREROOM LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER

NOTE: ONLY 3 HINGES REQUIRED @ DOORS 7'6" TALL OR SHORTER.

HEADING # 49 - (SINGLE WITH STOREROOM LOCKSET X CLOSER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	SURFACE CLOSER	4050 SCUSH	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	GASKETING	488S	BK	ZER

HEADING # 50 - (SINGLE WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X CLOSER X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 51 - (SINGLE WITH FAIL SAFE ELECTRIFIED RIM FIRE EXIT HARDWARE X CARD READER)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
1	EA	ELEC FIRE EXIT HARDWARE	RX-98-L-F-E996-06-FS	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER
1	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-FA		VON
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK TRIM AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 52 - (SINGLE WITH RIM FIRE EXIT HARDWARE)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	FIRE EXIT HARDWARE	98-L-NL-F-06	606	VON
1	EA	RIM CYLINDER	AS REQUIRED	606	SCH
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	606	IVE
1	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	GASKETING	488S	BK	ZER

HEADING # 53 - (PAIR WITH PUSH/PULL HARDWARE X HOLD OPEN CLOSER CLOSER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	DOOR PULL	8103EZ -0	606	IVE
2	EA	PUSH PLATE	8200	606	IVE
2	EA	SURFACE CLOSER	4050 HEDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 54 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 55 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 56 - (PAIR WITH STOREROOM LOCKSET X FLUSH BOLTS)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 57 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS X CLOSER AT ACTIVE LEAF)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 58 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS X CLOSER AT ACTIVE LEAF X GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
2	EA	ARMOR PLATE	8400 34" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	MEETING STILE	139G	G	ZER
1	EA	GASKETING	488S	BK	ZER
2	EA	DOOR SWEEP	39	G	ZER
1	EA	THRESHOLD	545/547/548 (VERIFY JAMB DEPTH)	G	ZER

HEADING # 59 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS X CLOSER AT ACTIVE LEAF X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 RW/PA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 60 - (PAIR WITH OFFICE LOCKSET X FLUSH BOLTS X CLOSER ON ACTIVE LEAF X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	OFFICE/ENTRY LOCK	L9050 06A L583-363	606	SCH
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER

HEADING # 61 - (PAIR WITH STOREROOM LOCKSET X FLUSH BOLTS X CLOSER AT ACTIVE LEAF)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

NOTE: ONLY 3 HINGES REQUIRED PER LEAF @ DOORS 7'6" TALL OR SHORTER.

HEADING # 62 - (PAIR WITH STOREROOM LOCKSET X FLUSH BOLTS X CLOSER AT ACTIVE LEAF)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	STOREROOM LOCK	L9080 06A	606	SCH
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	488S	BK	ZER

HEADING # 63 - (PAIR WITH FAIL SECURE ELECTRIFIED STOREROOM LOCKSET X FLUSH BOLTS X CLOSER ON ACTIVE LEAF X SOUND GASKETING X CARD READER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
1	EA	POWER TRANSFER	EPT10	SP313	VON
2	EA	MANUAL FLUSH BOLT	FB458	606	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	606	IVE
1	EA	EU MORTISE LOCK	RX-L9092EU 06A	606	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER
2	EA	DOOR CONTACT	679-05HM/WD	BLK	SCE
1	EA	POWER SUPPLY	PS902	LGR	SCE
1	EA	CARD READER	SPECIFIED ELSEWHERE		

ALL WIRING AND CONNECTIONS BY DIVISION 26.

OPERATIONAL DESCRIPTION:

IMMEDIATE EGRESS ALWAYS ALLOWED. ACCESS BY KEY OR BY CARD READER. CARD READER WILL UNLOCK LOCKSET AND ALLOW ACCESS. REQUEST TO EXIT AND DOOR CONTACT CONNECTED TO BUILDING'S SECURITY SYSTEM.

HEADING # 64 - (PAIR WITH SURFACE LESS BOTTOM ROD PANIC HARDWARE)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	PANIC HARDWARE	LD-9827-L-NL-LBR-06	606	VON
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 65 - (PAIR WITH SURFACE LESS BOTTOM ROD PANIC HARDWARE X GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	PANIC HARDWARE	CD-9827-L-LBR-06	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	488S	BK	ZER

HEADING # 66 - (PAIR WITH SURFACE LESS BOTTOM ROD PANIC HARDWARE X HOLD OPEN CLOSER)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	PANIC HARDWARE	CD-9827-L-LBR-06	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 HEDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	THRESHOLD	548G (VERIFY JAMB DEPTH)	G	ZER
2	EA	SILENCER	SR64	GRY	IVE

HEADING # 67 - (PAIR WITH SURFACE LESS BOTTOM ROD PANIC HARDWARE X HOLD OPEN CLOSER X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	PANIC HARDWARE	CD-9827-L-LBR-06	606	VON
2	EA	MORTISE CYLINDER	AS REQUIRED	606	SCH
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 HEDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 68 - (PAIR WITH SURFACE LESS BOTTOM ROD FIRE EXIT HARDWARE X CLOSER X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-F-LBR-06-499F	606	VON
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	DOOR SWEEP	52A	A	ZER

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	THRESHOLD	64G	G	ZER

HEADING # 69 - (PAIR WITH SURFACE LESS BOTTOM ROD FIRE EXIT HARDWARE X CLOSER X SOUND GASKETING)

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1 SERIES AS SPECIFIED	633	IVE
2	EA	FIRE EXIT HARDWARE	9827-L-F-LBR-06-499F	606	VON
2	EA	RIM CYLINDER	AS REQUIRED	606	SCH
2	EA	SURFACE CLOSER	4050 EDA	696	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	606	IVE
2	EA	STOP	WS407/FS436 AS SPECIFIED	606	IVE
1	EA	ASTRAGAL	328 X 2 PC	G	ZER
1	EA	GASKETING	870	G	ZER
2	EA	AUTO DOOR BOTTOM (MORT)	360	AA	ZER
1	EA	THRESHOLD	64G	G	ZER

HEADING # 70 - (COILING DOORS)

PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CYLINDER	AS REQUIRED	606	SCH
1		BALANCE OF HARDWARE	BY DOOR MANUFACTURER		

HEADING # 71 - (SPECIALTY DOORS)

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1		ALL HARDWARE	BY DOOR MANUFACTURER		

END OF SECTION

Section 08 80 00
GLAZING
(TRADE CONTRACT REQUIRED)

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
- B. Submit bid as directed by and in compliance with the Request for Bids, the Instructions to Bidders, and this Article 1.2.
- C. Submit bid on the bid form provided in the Project Manual.
- D. Submit bid in a sealed envelope in the manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- E. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Trade Contract, unless specifically called out otherwise, regardless of where among the Drawings it appears:
The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A104, A300, A301, A570, A605, A490, A002, A463, A503, A401, A402, A403, A404, A405, A406, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A426, A427, A429, A623, A400, A714, A560, A440, A441, A442, A710, A711, A713, A606, A428, A430, A431, A432, A433, A434, A435, A471, A472, A473, A600, A601, A604, A609, A620, A625, A607, A622, A715, A720, A721
1. Refer to Section 01 23 00 - Alternates, for Bid alternates which may affect the scope of Work of this Section.
- F. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None Required.
- G. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(G), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade

subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of MGL c. 149, §§ 44A-J.

- H. The BIDDING REQUIREMENTS, CONTRACT FORMS, and Contract Conditions as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.4 SUMMARY

- A. The work of this Section consists of glass and glazing work where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
1. Section includes general requirements and definition of glass types for glazing work specified under other individual specifications.
 2. Work of this Section includes installation of glazing beads furnished under related sections.
 3. Work of this Section includes designated Awarding Authority's proprietary products.
- B. Furnish and install the following:
1. Tempered glass in wood and hollow metal doors and frames.
 2. Tempered glass in interior aluminum frames.
 3. Wireless fire resistant rated glazing in designated rated doors and frames.
 4. Impact resistant interior glazing (security glazing).
 5. Interior glazing with applied safety/security glazing film.
 6. Frameless mirrors.
 7. Acoustical glass.
 8. All materials required to properly install glass furnished hereunder, including sealant, tapes, setting blocks, and spacers.
- C. Fabricate and furnish the following to respective trades for installation:
1. Tempered glass doors, panels and shelves for custom fabricated display cases; furnish to Section 06 41 00 – ARCHITECTURAL WOODWORK for installation.

1.5 RELATED REQUIREMENTS

- A. Section 01 43 39 - MOCKUPS: Requirements for exterior wall mock-up assembly requiring work of this Section.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 06 40 00 – ARCHITECTURAL WOODWORK: Display cases.
- D. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- E. Section 08 00 08 - GLASS AND GLAZING FILED SUB-BID REQUIREMENTS: Filed Subcontract requirements for the work of this Section 08 80 00.
- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Steel doors, door and window frames, and related glazing stops, for both fire-resistance rated (labeled) and non-rated (labeled) conditions.
- G. Section 08 14 16 - FLUSH WOOD DOORS: Factory-glazed wood doors.
- H. Section 08 43 13 - ALUMINUM-FRAMED STOREFRONTS: Storefront framing and door system, not included as part of Glazing Trade.
- I. Section 08 44 13 - ALUMINUM-FRAMED STOREFRONTS: Storefront framing and door system, not included as part of Glazing Trade.
- J. Section 08 63 00 – METAL FRAMED SKYLIGHTS: Shop glazed metal framed skylight assemblies.
- K. Section 08 86 00 - FIRE-RATED GLAZING AND FRAMING SYSTEMS: Specialized fire-rated framing and doors systems with wire-less fire-resistant glazing, included as part of the Glass and Glazing Filed Sub-Bid.
- L. Section 08 90 00 - LOUVERS AND VENTS: Factory glazed lite at elevator louver shaft.
- M. Section 10 28 13 - TOILET ACCESSORIES: Framed mirrors.

1.6 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. AAMA - Structural Sealant Glazing Systems.
 - 2. AAMA 804.1 - Ductile Back-Bedding Compound.
 - 3. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.
 - 4. ASTM C1036 - Flat Glass.

5. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.
 6. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
 7. ASTM E308 - Standard Recommended Practice for Spectrophotometry and Description of Color in CIE 1931 System.
 8. ASTM E546 - Test Method For Frost Point of Sealed Insulating Glass Units.
 9. ASTM E576 - Test Method for Dew/Frost Point of Sealed Insulating Glass Units in Vertical Position.
 10. ASTM E84 - Standard Method of Test for Surface Burning Characteristics of Building Materials.
 11. ASTM E903 - Standard Methods of Test for Solar Absorbance, Reflectance and Transmittance of Materials Using Integrating Spheres.
 12. ASTM G26 - Standard Practice for Performing Accelerated Outdoor Weatherizing for Non-metallic Materials Using Concentrated Natural Sunlight.
 13. Federal Safety Standards for Architectural Glazing Materials 16CFR1201.
 14. FS TT-S-001543A - Sealing Compound, Silicone Rubber Base.
 15. IGCC: Certified Products Directory, and Certification Guidelines.
 16. NFPA Publication 80 - Fire Doors and Windows.
 17. SGCC: Certified Products Directory, and Certification Guidelines.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
1. GANA Laminated Glazing Reference Manual (2009 edition).
 2. GANA - Glazing Manual (50th Anniversary edition).
 3. SIGMA - Vertical Glazing Guidelines, Number A3000-87.
 4. Consumer Product Safety Commission (CPSC) 16CFR 1201 Code of Federal Regulations for Architectural Glazing Materials.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 2. Glazing installed in wood frames: Closely coordinate work of this Section 08 80 00 with woodworking trades specified under Division 6. Assure that wood frames are installed plumb and true, and are securely anchored. Verify wood frames are properly routed with glazing rabbits clear from any obstruction, and equipped with wood stops to permit proper installation.
- B. Sequencing:
1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.

- b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
2. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Filed-Subcontract, have been received and approved by the Architect.
3. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.8 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.
- B. Installer of the Work of this trade is required to attend pre-installation conferences specified under the following specification sections:
 1. Section 06 40 00 – ARCHITECTURAL WOODWORK.

1.9 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data:
 - a. Product data sheets on glazing products: Provide chemical, functional, and environmental characteristics, size limitations, special application requirements. Identify available colors.
 - b. Sample Warranty: Provide copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 2. Shop Drawings: Show sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - a. Plans and elevations 1/4 inch scale of each type of glazing assembly, and mirror assembly; indicate dimensions, location of patch fittings, and reference details. Verify dimensions with field measurements.
 - b. Large scale design details of glazing conditions; indicating sizes, types, and gauges of all metal components; glazing details, indicating types and thickness of glass; bracing and stabilizing members; attachment clips and brackets; and complete installation details.
 3. Test and Evaluation Reports: Provide a Glass Stress Analysis for safety/security glazing film with specified glass/film combination by the film manufacturer.
 4. Verification Samples:
 - a. 12 x 12 inch pieces of each specified type and thickness of glass, bearing labels indicating locations where each type of glass will be used.
 - b. Glazing tape: 12 inch length of specified type and size.

5. Certificates: Manufacturer's written certification stating that the materials installed, meet or exceed the requirements specified under this Section.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.

1.10 QUALITY ASSURANCE

- A. General: Perform glazing work in accordance with GANA Glazing Manual, GANA Laminated Glazing Reference Manual, and SIGMA standards for glazing and installations methods.
 1. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Delegated design: Due to glazing detailing, and configurations, the glazing Work of interior pavillions requires structural design provide data, calculations and drawings signed and sealed by an engineer licensed in the state where the project is located.
- C. Glass Labeling:
 1. General: Manufacturer's Label shall be, acid-etched, sandblasted, ceramic-fired, laser-etched, embossed, or other similar type which, once applied, cannot be removed without being destroyed.
 2. Safety glass: Label tempered and laminated safety glass with permanent manufacturer's label on each light with the mark visible after installation.
 - a. Furnish SGCC certification for safety glass in compliance with CPSC 16 CFR 1201 Cat 1 or Cat 11, or ANSI Z-97.1.
 3. Fire-rated glass: Label each individual glazing unit with appropriate UL, Warnock Hersey, or other approval labeled markings with the listing mark visible after installation.
- D. Qualifications:
 1. Fabricators: Glazier specializing in applying the work of this Section with a minimum of 5 years of experience.
 2. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).
 3. Safety/Security Glazing Film Applicator: Provide documentation that the applicator is authorized by the Manufacturer of the window film to install said window film as per the Manufacturer's specifications.
 - a. Furnish authorization including film manufacturers ID number for applicator.

1.11 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in labeled, protective packages, when and as required.
- B. Storage and Handling Requirements:
 - 1. Store and handle in strict compliance with manufacturer's instructions and recommendations of GANA Glazing Manual. Use clean gloves and tools when handling materials, avoid contamination. Use rolling blocks and suction cups to move glass units not in shipping crates.
 - a. Carefully store materials to avoid overloading any building component or structure.
 - b. Do not unpack material until it is to be set, unless un-packing is required for inspection by the Architect.
 - 2. Store mirrors and coated glass in a dry place with acid-free paper between glass sheets.
 - 3. Protect factory finished materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.12 SITE CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees Fahrenheit.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.13 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty/Guarantee: All shall include replacement of defective glass and mirrors, and delivery of replacement glass products furnished f.o.b. from point of manufacturer to project site.
 - 1. Mirrors: Manufacturer's 5 year written guarantee covering against defects in materials and workmanship of reflective coatings on mirrors and replacement of the same.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of reflective coatings as evidenced by peeling, cracking, discoloration, deterioration in metallic coating, or other visual indications of failure.
 - 2. Laminated glass: Manufacturer's 4 year written guarantee covering against defects in materials and workmanship of laminated glass and replacement of the same. Warranty shall be effective from date of original factory shipment to site.

- a. Provide coverage in Guarantee for manufacturing defects, including failure of laminated glass units as evidenced by edge separation, delamination, or discoloration of inner layer.
3. Insulating Glass: Manufacturer's 10 year written guarantee covering insulating glass against defects in materials and workmanship, including failure of seals effective on date of original factory shipment to site.
 - a. Provide coverage in Guarantee for manufacturing defects, including failure of hermetic seal of air space (except by glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, deterioration of protected internal glass coating or other visual indications of seal failure or performance.

PART 2 - PRODUCTS

2.1 GLASS - GENERAL

- A. General requirements for glass: Of domestic and foreign manufacture, conforming to the referenced standards and with the additional requirements specified herein; factory labeled on each pane stating the strength, type, thickness and quality; with all labels remaining on glass until final cleaning.
 1. Glass thickness shown and heat treatment specified are minimum requirements. Provide glass thickness and heat treatment as required to meet specified performance criteria, State and local codes and ordinances.
- B. Insulated Glass Units: Conform to Class CBA of Insulating Glass Certification Council (IGCC), with a hermetically sealed dehydrated sealed air space, and tested in accordance with ASTM E 2190.
- C. Float Glass: Comply with ASTM C 1036, Class 1 clear, quality q3 glazing select.
- D. Heat Strengthened Glass: Comply with ASTM C 1048 HS, heat strengthened, Class 1 clear, quality q3 glazing select.
- E. Tempered Glass: Comply with ASTM C 1048 FT, fully tempered, Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
 1. Heat check all glass used for insulated units which are indicated to be covered over or buried by exhibit rockwork after installation.
- F. Laminated glass: consisting of an outer face and inner face of specified glass, factory laminated to polyvinyl butyl (PVB) interlayer, structural PVB, Ethylene Vinyl Acetate (EVA), or iconplast interlayer (SGP) as specified. Laminated glass shall be free from foreign substances and air pockets, and certified by Safety Glazing Certification Council.
 1. No substitutions will be considered for specified interlayers which are required for:
 - a. Specific visual design characteristics.
 - b. Impact resistant glazing.
 2. Acceptable Interlayer Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following:
 - a. Kuraray America, Inc., Wilmington DE.

- b. Eastman Chemical Company, Kingsport TN.
 - c. Schweitzer-Mauduit International, Inc. (SWM), Alpharetta GA.
- G. Mirror glass: ASTM C 1036, type 1 transparent, flat Class 1 clear, quality q1 mirror select glass, and ASTM C 1503 electro-copper back-plated laminated to a concealed from view corrosion-resistant zinc-coated back, with all edges of the glass ground and polished.

2.2 SURFACE-APPLIED SAFETY/SECURITY GLAZING FILM

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on 3M Window Film, St. Paul, MN., product: "3M™ Scotchshield™ Safety and Security Window Film, Ultra S800."
- 1. Surface-applied safety/security glazing film is an Awarding Authority's proprietary product: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the product(s) specified herein shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.
 - 2. Substitutions: The products specified herein establish standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the Contractor is hereby directed not to order any materials until said approval(s) are received in writing.
 - a. Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.
- B. Description: Optically clear polyester film, consisting of co-extruded micro-layers, with a durable acrylic abrasion resistant coating over one surface, and a UV stabilized pressure sensitive adhesive on the other. The film color is clear and will not contain dyed polyester.
- 1. Thickness: 8 mils (0.008 inches).
 - 2. Flammability: The Manufacturer shall provide independent test data showing that the window film shall meet the requirements of a Class A Interior Finish for Building Materials for both Flame Spread Index and Smoked Development Values per ASTM E-84:
 - a. Flame Spread Index (FDI): 5.
 - b. Smoke Developed Index (SDI): 25.
 - 3. Film properties:
 - a. Tensile Strength (ASTM D882):

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- 1) Base Film: 32,000 psi (MD) / 32,000 psi (TD).
 - 2) Coated Film: 27,000 psi (MD) / 27,000 psi (TD).
 - b. Break Strength (ASTM D882):
 - 1) Base Film: 190 lb/in (MD) / 190 lb/in (TD).
 - 2) Coated Film: 215 lb/in (MD) / 215 lb/in (TD).
 - c. Percent Elongation at Break (ASTM D882):
 - 1) Base Film: 110 % (MD) / 100% (TD).
 - 2) Coated Film: 95 % (MD) / 95% (TD).
 - d. Yield Strength at 3% Elongation:
 - 1) Base Film: 12,000 psi (MD).
 - 2) Coated Film: 15,000 psi (MD).
 - e. Percent Elongation at Yield (ASTM D882):
 - 1) Base Film: 7% (MD).
 - 2) Coated Film: 8% (MD).
 - f. Young's Modulus (ASTM D882):
 - 1) Base Film: 550 kpsi (MD) / 600 kpsi (TD).
 - 2) Coated Film: 550 kpsi (MD) / 600 kpsi (TD).
 - g. Graves Tear Resistance (ASTM D1004):
 - 1) Maximum Force (lbs):
 - a) Base Film: 40 (MD) / 40 (TD)
 - b) Coated Film: 40 (MD) / 40 (TD)
 - 2) Maximum Extension (in):
 - a) Base Film: 0.45 (MD) / 0.65 (TD)
 - b) Coated Film: 0.50 (MD) / 0.57 (TD)
 - 3) Graves Area Tear Resistance (lbs%):
 - a) Base Film: 1,100 (MD) / 1,300 (TD).
 - b) Coated Film: 1,100 (MD) / 1,300 (TD)
 - h. Puncture Propagation Tear Resistance (ASTM D2582):
 - 1) Coated Film: 9 lbf (MD) / 10 lbf (TD)
 4. Abrasion Resistance: The Manufacturer shall provide independent test data showing that the film shall have a surface coating that is resistant to abrasion such that, less than 5% increase of transmitted light haze will result in accordance with ASTM D-1044 using 100 cycles, 500 grams weight, and the CS10F Calibrase Wheel.
 5. Adhesion to Glass: The Manufacturer shall provide independent test data showing that the film shall have a 90-degree peel strength (adhesion to glass) according to ASTM D-1044 of at least 6 lbs/in.
 6. Impact Resistance for Safety Glazing: Manufacturer shall provide independent test data showing that the film, when applied to either side of the window glass, shall meet the 400 ft-lb impact requirements of 16 CFR 1201 (Category 2) and ANSI Z97.1 (Class A, Unlimited). Testing shall be done with film applied ¼ inch thick annealed glass.
 7. Windborne Debris Protection: pass ASTM E330 at a design pressure of 100 psf with 3M Impact Protection Adhesive attachment system
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8. Bomb Blast Mitigation: The Manufacturer shall provide independent test data showing the following:
 - a. GSA Rating of "2" (Minimal Hazard) / ASTM F1642 "No Hazard" with blast pressure of 7 psi and 42 psi*msec blast impulse, on 1/8" tempered single pane glass and 3M Impact Protection Adhesive Attachment system
 - C. Adhesive System: The film shall be supplied with a high mass pressure sensitive weatherable acrylate adhesive applied uniformly over the surface opposite the abrasion resistant coated surface. The adhesive shall be essentially optically flat and shall meet the following criteria:

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 GLASS TYPES

- A. Glass Type GL-21 - INT: Nominal 5/16 inch thick laminated safety glass.
 1. Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 2. Interlayer: 0.060 inch thick clear polyvinyl butyl interlayer
 3. Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass.
- B. Glass Type GL-22 - INT: Acoustical Glass (consists of two lites Glass Type GL-21).
- C. Glass Type GL-23 - INT: Nominal 19/32 inch thick laminated security glass.
 1. Inner Layer: 19/32 inch (15mm), clear laminated security glass.
 - a. Basis of Design: School Guard Glass, Adams MA. product SSG4, (Owner designated proprietary product).
 - 1) Outer face: 1/4 inch (6 mm) thick heat strengthened clear glass.
 - 2) Interlayer: School Guard Glass SSG4 proprietary interlayer.
 - 3) Inner face: 1/4 inch (6 mm) thick heat strengthened clear glass.
 - b. Glass Type GL-23 is an Awarding Authority's proprietary product: Under provisions of Massachusetts General Laws, Chapter 30, Section 39M(b) the Awarding Authority has determined that the product(s) specified herein shall be proprietary for 'sound reasons in the public interest'. This determination has been made under vote of the Awarding Authority, and has been recorded in writing for public record.
 - c. Substitutions: The products specified herein establish standards of quality, design and function desired, and have been deemed proprietary. Under provisions of Massachusetts General Laws, Chapter 149, other equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in the CONDITIONS OF CONTRACT and Division 1 - GENERAL REQUIREMENTS. Further additional information may be requested by the Architect for determination that the proposed product substitution is fully equal to the specified product(s). There is no guarantee that proposed substitutions will be approved, and the

Contractor is hereby directed not to order any materials until said approval(s) are received in writing.

- 1) Requesting substitutions for the products specified herein is at the Contractor's own risk, with regard to uncompensated delays of the Project. Time is required for sufficient review and additional requests for information. Delays of work which result from substitution reviews and resubmissions are not grounds for additional time or cost change orders, and will not be considered by the Awarding Authority.
- D. Glass Type GL-24 - INT: Nominal 3/8 inch thick laminated safety glass with gradated interlayer.
1. Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 2. Interlayer 1: 0.060 inch thick clear polyvinyl butyl interlayer
 3. Interlayer 2: 0.015 inch (0.38 mm) thick gradated pigmented inter-layer.
 - a. Basis of Design Pattern: Decorative Films, LLC., product Solyx Decorative Glazing Film pattern N°. "SXJ-0500."
 - 1) Solar Transmittance: 0.10 percent
 - 2) Visible light transmittance: 0.08 percent.
 - 3) Shading coefficient: 0.26.
 - 4) Solar Heat Gain Coefficient (SHGC): 0.22.
 4. Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass.
- E. Glass Type GL-25 - INT: Nominal 5/16 inch thick laminated safety glass with applied safety/security film.
1. Composition:
 - a. Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 - b. Interlayer: 0.060 inch thick clear polyvinyl butyl interlayer
 - c. Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass with surface applied safety/security film.
- F. Glass Type GL-26 - INT: Acoustical Glass (consists of two lites Glass Type GL-21), with applied safety/security film applied to 'in-room' surface.
- G. Glass Type GL-27 - INT: Nominal 3/8 inch thick laminated safety glass with gradated interlayer, and applied safety/security film.
1. Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 2. Interlayer 1: 0.060 inch thick clear polyvinyl butyl interlayer
 3. Interlayer 2: 0.015 inch (0.38 mm) thick graduated pigmented inter-layer.
 - a. Basis of Design Pattern: Decorative Films, LLC., product Solyx Decorative Glazing Film pattern N°. "SXJ-0500."
 - 1) Solar Transmittance: 0.10 percent
 - 2) Visible light transmittance: 0.08 percent.
 - 3) Shading coefficient: 0.26.
 - 4) Solar Heat Gain Coefficient (SHGC): 0.22.
 4. Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass with surface applied safety/security film.

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- H. Glass Type GL-28 – INT Acoustical Glass: Consists of two lites of nominal 5/16 inch thick laminated safety glass.
1. Outer face: 1/8 inch (3 mm) thick heat strengthened clear glass
 2. Interlayer 1: 0.060 inch thick clear polyvinyl butyl interlayer
 3. Interlayer 2: 0.015 inch (0.38 mm) thick gradated pigmented inter-layer.
 - a. Basis of Design Pattern: Decorative Films, LLC., product Solyx Decorative Glazing Film pattern N°. "SXJ-0500."
 - 1) Solar Transmittance: 0.10 percent
 - 2) Visible light transmittance: 0.08 percent.
 - 3) Shading coefficient: 0.26.
 - 4) Solar Heat Gain Coefficient (SHGC): 0.22.
 4. Inner face: 1/8 inch (3 mm) thick heat strengthened clear glass with surface applied safety/security film on "in-room" surface.

3.2 SCHEDULE – SAFETY GLASS CRITERIA

- A. Safety Glass (fully tempered glass or laminated) glass is required at conditions identified by applicable codes, which include, but are not limited to the following:
1. Glazing in swinging doors except jalousies.
 2. Glazing in fixed and sliding panels of sliding patio door assemblies and panels in other doors, including walk-in closets and wardrobes.
 3. Glazing in storm doors.
 4. Glazing in unframed swinging doors.
 5. Glazing in doors and enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers.
 6. Glazing in any portion of a building wall enclosing these above compartments where the exposed edge of the glazing is less than 60 inches above a standing surface.
 7. Glazing in a individual fixed or operable panel adjacent to a door where the nearest exposed edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above a walking surface. (panels where there is an intervening wall or other permanent barrier between the door and the glazing are exempt.)
 8. Glazing in an individual fixed or operable panel where the exposed area of an individual pane is greater than 9 square feet and the exposed bottom edge is less than 18 inches above the floor, the exposed top edge is greater than 36 inches above the floor, and one or more walking surface(s) are within 36 inches horizontally of the plane of the glazing. Exceptions include a panel with a protective bar (1-1/2 inches or more in height and capable of withstanding a horizontal load of 50 pounds per linear foot without contacting the glass installed on the accessible sides of the glazing 34 inches to 38 inches above the floor), and an outboard pane in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet or more above any grade, roof, walking surface of other horizontal or sloped surface adjacent to the glass interior.
 9. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of height above a walking surface.

10. Glazing in walls and fences enclosing indoor and outdoor swimming pools and spas when the bottom edge of the glazing on the pool side is less than 60 inches above a walking surface on the pool side of the glazing and the glazing is within 60 inches horizontally of a water's edge.
11. Glazing adjacent to stairways, landings and ramps when it is within 36 inches horizontally of a walking surface, within 60 inches horizontally of a bottom tread of a stairway in any direction, and the bottom edge is less than 60 inches above the plane of the adjacent walking surface (or stairway, measured from the nose of the tread).

2.5 FABRICATION

- A. General: Do not fabricate materials until all specified submittals have been submitted to, and approved by, the Architect.
- B. Fabricate glass as required to openings with edge clearances and bite on glass as recommended by the manufacturer with clean-cut edges where concealed, and smooth-ground, polished and seamed edges where exposed to view. Do not cut, seam, nip or abrade glass after heat-tempering.
 1. For non-tempered to be cut at site, provide glass larger than required so as to obtain clean cut edges without seaming or nipping.
- C. Fabricate glass with the following edge treatments.
 1. Exposed edges: Polished-finished radiused (penciled).
 2. Concealed edges: Cut edges with minimum edge work.
 3. Butt-joint edges: Flat round and finished with edges eased.
- D. Shop Fabrication:
 1. All vision panels and baffles shall be cut to size by manufacturer or by fabricator prior to delivery to site. All glass edges shall be ground smooth, polished and eased. Provide all necessary holes wherever required by the approved Shop Drawings, drilled and tapped to suite project requirements. Do all cutting and drilling prior to tempering.
 2. Mirrors: All mirrors shall be cut to size by fabricator prior to delivery to site. Carefully coordinate and provide notches and holes for mirror installations which are indicated to receive ballet barres, handrails and other products specified in individual Specification Sections, which protrude through mirror installation.

2.6 ACCESSORIES

- A. Glazing tape: Preformed butyl-polyisobutylene rubber with 100 percent solids contained in extruded tape roll form and complying with AAMA 804.1; coiled on release paper; of sizes required for proper glazing. equal to one of the following:
 1. Protective treatments 3030 or 606.
 2. Tremco Preshimmed 440.
 3. Woodmont Chem-Tape 40.
- B. Setting blocks: Neoprene, 80-90 shore A durometer hardness, certified to be "silicone compatible"; sized as follows:

1. Length: 0.1 inch per square foot of glass, but not less than 4 inches.
 2. Width: equal to glazing rabbet space minus 1/16 inch.
 3. Height to suit glazing method and pane weight and area.
- C. Spacers: Neoprene, 60-80 shore A durometer hardness; sized as required.
- D. Mirror mastic for glass mirrors: Asphalt-based adhesive mirror mastic compatible with mirror backing for adhesive application to wall substrate. Provided mastic wall-board sealer as recommended by adhesive manufacturer.
1. Palmer Products Corporation, Louisville, KY., product: "Palmer Mirror Mastic".
 2. Pecora Corporation, Harleysville PA, product "7hr4 Mirror-Tac".
 3. Royal Adhesives and Sealants, South Bend, IL, "Gunther Brand" product "Ultra/Bond Mirror Mastic"
- E. Top continuous J-channel mirror support: Brite anodized aluminum or stainless steel J-shape mirror channel designed for 1/4 inch mirrors, minimum 0.375 inch support height, equal to C.R. Laurence Co., Inc., Los Angeles CA., "CRL Brite Anodized 1/4 Inch Deep-Nose Aluminum J-Channel", model N°. D645BA, or approved equal
- F. Bottom continuous J-channel mirror support: Brite anodized aluminum or stainless steel J-shape mirror channel designed for 1/4 inch mirrors, minimum 0.625 inch support height, equal to C.R. Laurence Co., Inc., Los Angeles CA., "CRL Brite Anodized 1/4 Inch Standard Aluminum J-Channel", model N°. D636BA, or approved equal.
- G. Glazing sealant:
1. General glazing sealant: One-part medium modulus, neutral curing, synthetic rubber sealant, having a useful life expectancy of at least 20 years, conforming to ASTM C 920, Type S, grade NS, Class 25 for uses NT, G and A, FS TT-S-001543A, Type, Class A. Color as selected by Architect.
 - a. Dow Corning Corporation, Midland MI.; product, "Silicone Glazing Sealant".
 - b. General Electric Company (GE Silicones) Waterford NY.; product, "SilGlaze II SCS2800".
 - c. Tremco, Beachwood OH.; product, "Proglaze.
- H. Bond-breakers and backing materials: Type recommended by manufacturer of sealants and gaskets.
- I. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.
- 2.7 ACCESSORIES FOR WIRE-LESS FIRE-RATED GLAZING
- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2.5 percent.
- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both

extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:

1. Dow Corning Corporation, Midland MI.; product, "795".
 2. General Electric Company (GE Silicones) Waterford NY.; product "Silglaze-II 2800"
 3. Tremco, Beachwood OH.; product, "Spectrem 2".
- C. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.

2.8 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.9 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Inspect receiving surfaces and ensure that they are dry and free from dust, or other foreign materials before glazing. Clean all surfaces with cloth saturated with mineral spirits of high-flash naphtha as recommended by glazing tape manufacturer, before glazing.
- B. Field Measurements: Verify that field measurements are as indicated on approved Shop Drawings.
 - 1. Check all openings, prior to glazing, to make certain that the opening is square, plumb and secure in order that uniform face and edge clearances are maintained.
 - 2. Determine the actual sizes required by measuring the receiving openings. Size glass and mirrors to permit required clearance and bite around full perimeter of glass, as set forth in the referenced FGMA standards, or as recommended by the glass manufacturer. Do not nip edges, to remove flares or to reduce oversize dimensions, under any circumstance.
- C. Beginning of installation means acceptance of existing conditions.

3.2 GENERAL INSTALLATION OF GLASS HAVING PERMANENT LABELS

- A. Install glass units so that appropriate manufacturer's permanent label for safety glass, and permanent label for fire-rated glass are visible.

3.3 INSTALLATION - DRY GLAZING

- A. Utilize dry glazing methods for field installation of glass in interior doors and frames.
 - 1. Install in vision panels in fire-rated doors and frames to requirements of NFPA 80.
- B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (2 mm) above sight line.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane.
- E. Place glazing tape on free perimeter of glazing in manner as described above.
- F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- G. Knife trim protruding tape.

3.4 INSTALLATION - WET GLAZING

- A. Utilize wet glazing methods for field installation of glass in exterior storefront and window systems.

- B. Place setting blocks at quarter points on web of sill receiving member. Set glass unit in place with equal spaces on all sides.
- C. Install spacers at a spacing not exceeding 24 inches apart uniformly around perimeter, between interior face of glass unit and the fixed glazing rabbet.
- D. Apply a continuous heel bead of specified sealant between the outer edges of the glass unit and the web of the receiving member, in sufficient quantity to engage the leg of the applied glazing stop, when installed.
- E. As the glazing stop is being applied, install spacers between the outer face of the glass unit and the stop, locating the spacers directly opposite the previously installed interior spacers. Install the glazing stops, ensuring that all clearances around the perimeter of the glass unit conform to the requirements of the respective standards referenced herein.
- F. Apply a continuous bead of sealant around the exterior and interior perimeters, between the glass unit and the fixed rabbet, and between the glass unit and the applied glazing stop, extending the sealant material slightly above the sight line to permit proper tooling thereof.
- G. Tool all exposed sealant at a 45 degree angle away from the glass surface, leaving the sealant surface uniformly dense and smooth.
- H. Immediately remove all excess sealant from surfaces of metal and glass.

3.5 APPLICATION SAFETY/SECURITY GLAZING FILM

- A. Install in strict accordance with manufacturer's instructions.
- B. Cut film edges neatly and square at a uniform distance of 1/8 inch to 1/16 inch of window sealant. Use new blade tips after 3 to 4 cuts.
- C. Spray slip solution on window glass and adhesive to facilitate proper positioning of film.
- D. Apply film to glass and lightly spray film with slip solution.
- E. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
- F. Bump film edge with lint-free towel wrapped around edge of a 5-way tool.
- G. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.
- H. After film dries (30 days after application), wash film using common window cleaning solutions, excluding ammonia solutions. Do not use abrasive type cleaning agents and bristle brushes to avoid scratching film. Use synthetic sponges or soft cloths.

3.6 INSTALLATION - MIRRORS

- A. Examination: Verify that substrates to receive mirrors are plumb, true and of solid construction capable of supporting mirrors.
- B. Secure clips at quarter points unless otherwise detailed on the Drawings.
- C. Apply mirror mastic in accordance with manufacturer's instructions. Do not cover more than 25 percent of mirror back.
- D. Carefully adjust mirrors for perfectly plumb installations and to assure that reflected vertical and horizontal images are parallel to axis of room, and that all mirrors in any gang reflect a true and consistent image across their entire collective face. Distortion of images within any mirror panel, shifting of images, and double joints shall be corrected.
- E. Apply mirror into the clips and to the substrate so that areas not covered with mastic will remain open for ventilation with 1/8 inch minimum clearance from substrate. Secure the top edge of mirror with clips.
- F. Provide temporary rigid support until mastic sets.

3.7 PROTECTION

- A. Protect glass from breakage immediately upon installation. Use streamers or ribbons suitably attached to framing and held free of the glass. Do not apply warning markings directly to the glass.
- B. Cover glass to protect it from activities that might abrade the glass surface.

3.8 CLEANING

- A. Clean glass surfaces promptly after installation, exercising care to avoid damage to the same. Remove excess glazing tape, labels, dirt, and other contaminants.

End of Section

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Section 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Prefinished aluminum exterior fixed storm louvers, complete with aluminum wire mesh bird screens and related items, for indicated locations.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 07 92 00 - JOINT SEALANTS: Providing perimeter sealant and backing materials.
- D. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING:
 - 1. Furnishing and installing motorized dampers.
 - 2. Blank-off plates on back side of louvers.
- E. Division 26 – ELECTRICAL;
 - 1. Power supply to motorized louvers.
 - 2. Connections to control terminals for smoke detection devices and fire alarm system activation of louver.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

2. ASCA 96 - Voluntary Specification for Performance of Organic Coatings on Architectural Aluminum Curtainwall, Extrusions and Miscellaneous Aluminum Components.
3. AMCA Standard 500-L - Laboratory Methods of Testing Louvers for Rating.
4. AMCA Publication 501, "Application Manual for Air Louvers".
5. ASTM B 209 - Aluminum-Alloy Sheet and Plate.
6. ASTM B 221 - Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each type of louver and related components furnished hereunder.
 2. Certifications: Provide AMCA and BSRIA test data to confirm that the louvers have the specified air and water performance characteristics.
 3. Manufacturer's sample warranties for louvers and finishes.
 4. Schedule: Schedule of all louvers to be furnished hereunder, indicating locations for each size and type of louver, and locations and sizes of blank off panels.
 5. Shop drawings:
 - a. Large scale details of louver and blank off panel construction, indicating all sizes, gages, and thickness; large scale details of bird screens and accessory items; and complete installation details, coordinated to the specific receiving conditions. All details bearing dimensions of actual measurements taken at the project.
 6. Samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 - b. 12 inch long finish samples of louver frame showing each type material finish and color selected.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with AMCA Certification for louvers. Mark units with AMCA Certified Ratings Seal.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in an elevated dry location, protected by waterproof coverings.

1.8 WARRANTY

- A. Provide the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Louver manufacturer's standard warranty.

2. 10 year warranty on louver finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.
3. 10 year warranty on polyvinylidene fluoride enamel finish which shall include covering the applied finish against defects, including color fading, chipping, crazing, pitting, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Airlite Company, Marietta, OH.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Airlite Company, Marietta, OH.
 2. Construction Specialties, Inc., Cranford, NJ.
 3. Industrial Louvers, Inc., Delano, MN.
 4. Ruskin Company, Grandview, MO.

2.2 PERFORMANCE REQUIREMENTS

- A. Structural performance: Engineer louvers as specified herein for full inward and outward lateral load prescribed by applicable codes for this project location.
 1. Design Wind Loading: Louvers shall be designed and fabricated to conform to the *International Building Code*, 2015 edition, as published by the International Code Council, Inc. (I.C.C.), as revised by *Massachusetts State Building Code*, Ninth edition.
 - a. Basic wind speed of 137 miles per hour (3 second gust), both positive (acting inward) and negative (acting outward) wind pressure loading.
 - 1) Building Risk Category: III.
 - 2) Building Exposure: C.
 2. Fabricate louvers to provide for movement of components without damage, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 3. Fabricate louvers to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 ARCHITECTURAL LOUVERS

- A. Vertical Blade Louver Type: Nominal 5 inch deep architectural vertical blade high-volume louver, in dimensions shown on the Drawings. Louvers shall be stationary, vertical fixed,
1. Basis of Design Airlite Model SCV501, or approved equal.
 2. Nominal Louver depth: 5 inches (127.0 mm).
 3. Framing: Heads, sills, jambs and mullions to be one piece structural members of 6063-T5 alloy minimum 0.081 inch (2 mm) thick.
 4. Blades: Vertical arrangement, continuous design, minimum 0.060 inch (1.52 mm) thick extruded 6063-T5 alloy.
 - a. Fabricate louver with close-fitting, splice joints in exterior blades designed to permit expansion and contraction without deforming blades or framework and with mullions recessed from front edges of blades so exterior blades have continuous appearance.
 5. Screen: 1/2 inch mesh by 0.063 inch (1.6 mm) diameter bird screen secured within a extruded aluminum frame.
 6. Performance criteria:
 - a. Minimum Free Area: 54.4 percent (As determined in accordance with AMCA Standard 500, and certified by AMCA Standard 511), 8.71 square feet free area per 4'-0" by 4'-0" sized unit.
 - b. Free Area Velocity at beginning point of water penetration: Water penetration shall not exceed 0.01 ounces of water per square foot of free area at a velocity of 1,250 FPM when tested per AMCA Standard 500.
 - c. Air volume delivered at beginning point of water penetration: 10,888 CFM.
 - d. Pressure Drop at beginning point of water penetration: 0.27 inches water.
 - e. Design louver to sustain a wind loads specified, but not less than 25 pounds per square foot.

2.5 ACCESSORIES

- A. Fasteners and Anchors: Stainless steel type.
- B. Primer: Zinc chromate, alkyd type.
- C. Flashings: Of same material as louver frame.
- D. Perimeter Sealant: Provided under Section 07 92 00 - JOINT SEALANTS.

2.6 FACTORY FINISHING

- A. Finish (aluminum components): Shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based, high performance thermoplastic organic coating applied to all exposed surfaces, including all exposed screws, fastenings. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605, NAAMM - Metal Finishes Manual, and the following:

1. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis, Inc. product "Hylar 5000".
 2. Basis of Design: P.P.G. Industries Inc.; product "DuranarMica Sunstorm: in 'metallic' color to match Architect's control sample.
 - a. Finish Coating shall be manufactured as one of the following products:
 - 1) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 2) Akzo Nobel; product: "Trinar Tri-Escent II."
 - 3) Sherwin Williams (formerly Valspar), product: "Fluropon Classic II."
 3. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM D5723..
 4. Primer: "Coastal Primer" Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 5. Finish Coat (Color Coat): Polyvinylidene flouride enamel averaging 1.00 mil dry film thickness.
- B. Concealed Steel Items: Galvanized in accordance with ASTM A386 to 2.0 ounces per square foot.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that prepared openings and flashings are ready to receive the work of this Section and opening dimensions are as indicated on the shop drawings. Verify that all blocking and nailers are set in place and secure.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install louver assembly in accordance with manufacturer's instructions. Erect louvers plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.
 1. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
 2. Secure louvers in opening framing with concealed fasteners.
 3. Install bird screen and frame to interior of louver. Hinge screens for access.
- B. No permanent exposed to view labels of any kind will be permitted to remain on the louvers or frames.

3.3 TOLERANCES

- A. Maximum Variation from Level or Plumb: 0.06 inches every 3 feet non-cumulative or 0.5 inches per 100 feet, whichever is less.

3.4 CLEANING AND TOUCH UP

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Remove excess sealant by solvent acceptable to sealant manufacturer. All exposed edges of sealant and gaskets shall be left smooth, uniform in line, and with edges neatly struck.
- C. Remove protective material from prefinished aluminum surfaces. Wash down exposed surfaces free of dirt, handling marks, packing tapes, and foreign matter, using a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- D. Touch-up all scratches, abrasions, and other defects in the prefinished metal surfaces with shop-coat finish material, supplied with the various items to be furnished hereunder.

End of Section

Section 08 91 12

COMMISSIONING OF BUILDING ENCLOSURE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This section includes commissioning process requirements for building enclosure systems and assemblies and equipment.
- B. Related Sections:
 - 1. Division 01 Section “General Commissioning Requirements” for general commissioning process requirements.

1.3 DESCRIPTION

- A. Refer to Division 01 Section “General Commissioning Requirements” for the description of commissioning.

1.4 DEFINITIONS

- A. Refer to Division 01 Section “General Commissioning Requirements” for definitions.

1.5 SUBMITTALS

- A. Refer to Division 01 Section “General Commissioning Requirements” for CxA’s role.
- B. Refer to Division 01 Section “Submittal Procedures” for specific requirements. In addition, provide the following as required:
 - 1. Certificates of readiness
 - 2. Certificates of completion of installation, prestart, and startup activities
 - 3. O&M manuals
 - 4. Test Reports.

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer' calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 – PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment / system being tested. For example, the contractors of Division 4, 7 and 8 shall ultimately be responsible for all standard testing equipment for the Building Assembly systems in Divisions 4, 7 and 8.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 – EXECUTION

3.1 GENERAL DOCUMENTATION

- A. **Red-lined Drawing:** The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawing. Preliminary red-lined drawings must be made available to the Commissioning Team

for use prior to the start of Functional Performance Testing. Changes, as a result of Functional Testing must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.

- B. **Operation and Maintenance Data:** Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.
- C. **Demonstration and Training:** Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the contractor to the CxA four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior to the training session.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Perform tests as required in Divisions 04, 07 and 08. In addition, the following test shall be performed by the applicable installing contractor.
 - 1. In addition to the services outlined in the project specifications acceptance testing of newly installed window and door systems shall include water penetration testing in accordance with ASTM E1105 and acceptance testing of new roofing systems shall include field uplift testing in accordance with ASTM E907 as applicable. These tests are included in this commissioning specification and are to be performed under the construction contract and witnessed and evaluated by the commissioning consultant.
- B. Participate in building assembly systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- C. Provide information requested by the CxA for final commissioning documentation.
- D. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- E. Prepare preliminary schedule for building assembly system orientations and inspections, operation and maintenance manual submissions, training sessions, equipment start-up task completion for owner. Distribute preliminary schedule to commissioning team members.
- F. Update schedule as required throughout the construction period.
- G. Assist the CxA in all verification and functional performance tests.

-
- H. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
 - I. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.
 - J. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
 - K. Participate in, and schedule vendors and contractors to participate in the training sessions.
 - L. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
 - M. The equipment supplier shall document the performance of his equipment.
 - N. Provide a complete set of red-lined drawings to the project team.
 - O. Equipment Suppliers
 - 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
 - 2. Assist in equipment testing per agreements with contractors.
 - 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
 - P. Refer to Division 01 Section "General Commissioning Requirements" for additional Contractor responsibilities.

3.3 CxA'S RESPONSIBILITIES

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.4 TESTING PREPARATION

- A. Certify in writing to the project team that Building Assembly systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the project team that any Building Assembly instrumentation and controls have been completed and calibrated, that they are operating according to the Contract Documents.
- C. Certify in writing that testing procedures have been completed and that testing reports have been submitted, discrepancies corrected, and corrective work approved.

- D. Place systems, subsystems, and equipment into operating mode to be tested if applicable (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified.
- F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as required by specifications.

3.5 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform required testing.
- B. Tests will be performed using design conditions whenever possible.
- C. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- D. If tests cannot be completed because of a deficiency outside the scope of the Building Assembly system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- E. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 BUILDING ASSEMBLY SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. **Equipment Testing and Acceptance Procedures:** Testing requirements are specified in individual Division 4, 7 and 8 sections. Provide submittals, test data, inspector record and certifications to the project team.
- B. **Building Assembly System Testing:** Field testing plans and testing requirements are specified in Divisions 4, 7 and 8.
- C. **Building Assembly System Testing:** Provide technicians, instrumentation, tools and equipment to test performance of designated systems and devices.
- D. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:
 - i. Building Envelope
 - a. Exterior Walls, Windows & Doors

- b. Louvers and vents
 - c. Grilles and sunscreens
 - d. Infrared scan of envelope (performed by CxA)
 - ii. Roofing
 - a. Roofing systems, including parapet
 - b. Roofing openings, including skylights, pipe chases, ducts, etc.
 - c. Infrared scan of roof (performed by CxA)
- 3.7 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT
 - A. Refer to Division 01 Section "Commissioning Requirements" for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.
- 3.8 APPROVAL
 - A. Refer to Division 01 Section "Commissioning Requirements" for approval procedures.
- 3.9 DEFERRED TESTING
 - A. Refer to Division 01 Section "Commissioning Requirements" for requirements pertaining to deferred testing.
- 3.10 OPERATION AND MAINTENANCE MANUALS
 - A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
 - B. Refer to Division 01 Section "Commissioning Requirements" for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.
- 3.11 TRAINING OF OWNER PERSONNEL
 - A. Refer to Division 01 Section "Commissioning Requirements" and individual specification sections for requirements pertaining to training.

End of Section

Section 09 00 03

TILE TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
1. Specification requirements for Trade Contract "TILE" include all of the following listed Specification Sections: in their entirety:
 - a. Section 09 00 03 –TILE TRADE CONTRACT REQUIREMENTS.
 - b. Section 09 30 00 - TILING.
 - c. Section 09 30 16 – QUARRY TILING
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None.
- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A401, A402, A403, A404, A405, A406, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A427, A429, A400, A440, A441, A442, A713, A606, A600,

A453, A450, A451, A452, A603, A141A, A141B, A141C, A141D, A142A, A142B, A142C, A143A, A143B, A143C, A712, A801, FS100, FS101, FS102, FS103

2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
 3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- G. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which affect the scope of Work of this Trade.
- H. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE
CONTRACTOR: _____
TRADE CONTRACT FOR TRADE: TILE.
 2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate 1 affects the scope of work of Section 09 30 00.
- B. Section 03 33 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- C. Section 09 30 00 - TILING.
- D. Section 09 30 16 – QUARRY TILING

1.4 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.5 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

- a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
- b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 09 00 06
RESILIENT FLOORING FILED SUB-BID REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section is work of a Publicly Bid Trade Contractor and includes the following requirements.
1. Specification requirements for the Trade Contract "RESILIENT FLOORING" includes all work of the following listed Specification Sections, in their entirety:
 - a. Section 09 00 06 - RESILIENT FLOORING FILED SUB-BID REQUIREMENTS.
 - b. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
 - c. Section 09 65 23 - RUBBER FLOORING.
 - d. Section 09 65 43 - LINOLEUM FLOORING.
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None.
- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C, A102D, A103, A103A, A103B, A103C, A401, A402, A403, A404, A405, A406,

A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A427, A429, A400, A440, A441, A442, A713, A606, A600, A450, A141A, A141B, A141C, A141D, A142A, A142B, A142C, A143A, A143B, A143C, A712, A801, A605, A426, A623, A714, A428, A430, A431, A432, A433, A434, A435, A471, A472, A473, A601, A604, A609, A620, A625, A607, A720, A721, A470, A460, A461, A700, A602, A621, A650, A651, A652, A690

2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

- G. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which affect the scope of Work of this Trade.
- H. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE
CONTRACTOR: _____
TRADE CONTRACT FOR TRADE: RESILIENT FLOORING.

2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Owner will not be responsible for errors, omissions and/or charges for extra work arising from Trade Contractor's failure to familiarize themselves with the Contract Documents and existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 SUMMARY

- A. This Section includes Resilient Flooring Filed-Sub Bid Requirements and includes general requirements for preparation, installation and temporary protection of resilient flooring provided under this Filed-Sub-Bid.

1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
 - a. Grinding down high spots of substrate.
 - b. Providing Portland cement-based latex underlayment (filler).

1.5 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate number 1 affects the scope of work of Section 09 65 43.
- B. Section 03 33 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- C. Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING: General requirements for preparation, installation and temporary protection for flooring work which is NOT included as part of this Filed Sub-Bid.
- D. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES.
- E. Section 09 65 23 - RUBBER FLOORING.
- F. Section 09 65 43 - LINOLEUM FLOORING.
- G. Section 09 65 66 - RESILIENT ATHLETIC FLOORING.

1.6 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES .
 1. ASTM D 4259 - Standard Practice for Abrading Concrete.
 2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 4. ASTM F 710 - Preparing Concrete Floors to Receive Resilient Flooring.
 5. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 6. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
 7. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.7 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation,

- and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Coordinate work of this Filed-Subcontract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
 3. Coordinate the work of this Section with the respective trades responsible for installing interfacing work.
- B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - Project Management and Coordination. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
1. Required attendees:
 - a. Owner's Representative.
 - b. Architect.
 - c. General Contractor.
 - d. Project Superintendents representing each floor system installer.
 - e. Manufacturer's technical representative(s) for flooring products as designated by Architect or Contractor.
 - f. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of related work specified under the following Sections:
 - 1) Section 09 61 03 – Water Vapor Emission Control.
 - 2) Section 09 65 19 – Resilient Tile Flooring
 - 3) Section 09 65 23 - Rubber Flooring.
 - 4) Section 09 65 43 - Linoleum Flooring.
 - 5) Section 09 65 66 - Resilient Athletic Flooring.
 2. Agenda:
 - a. Scheduling of preparation and flooring operations.
 - b. Procedures for testing of relative humidity and moisture content of in situ substrates.
 - c. Water vapor emission control methods.
 - d. Review of staging and material storage locations.
 - e. Coordination of work by other trades.
 - f. Protection of completed Work.
 - g. Establish humidity and temperature limitations for performing the work, to which Architect and Contractor must agree.
 - h. Discuss process for inspection and acceptance of completed Work of this Section.
- C. Sequencing:
1. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

2. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
3. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect and OPM, in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
4. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
5. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
6. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.8 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Test and Evaluation Reports: Include the following:
 - a. Report the Test Deployment Parameters at start of testing and finishing of testing:
 - 1) Start and finish dates and times of testing.
 - 2) Ambient temperature,
 - 3) Ambient relative humidity and dew point temperature.
 - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
 - b. Report the "Factor" used to calculate the actual test area of the Calcium Chloride test site.
 - c. Report the concrete slab thickness (in inches).
 - d. Report all test results in chart form listing the following:
 - 1) Test locations (also mark test locations on floor plan)
 - 2) Type(s) of Existing Floor Coverings
 - 3) Visual Distress Level of existing Floor Coverings
 - 4) Surface Temperature of Concrete
 - 5) pH Paper/ Pencil Reading (ASTM F 710)
 - 6) Visual Appearance of Concrete
 - 7) Concrete Slab Age
 - 8) Relative Humidity in Concrete, % (ASTM F 2170):
 - a) Depth of hole from top of Slab, in.
 - b) RH in concrete, %

- c) Temp. in concrete, °F
 - 9) Surface Moisture Meter Test (ASTM E 1907):
 - a) 1. Electrical Impedance Test Values or
 - b) 2. Electrical Resistance Test Values
 - 10) x. Moisture Vapor Emission (MVER) - CaC12 Test (ASTM F 1869):
 - a) Weight Gain in grams
 - b) Exposure Time/hrs
 - c) MVER Lbs/1000 Sq. Ft./24 hours
 - e. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

1.9 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) Testing for concrete slabs and floors.
1. Resilient Flooring Filed-Subcontractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the General Contractor, Resilient Flooring Filed-Subcontractor and Owner's Project Representative.
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor provided under this Filed-Sub-Bid is to be installed.
 2. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.
 - 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.
 3. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Additional testing shall comply with requirements and in quantities as initial tested, and be included as Work of this Filed Sub-Bid.
 - 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating,

environmental controls, or moisture mitigation treatment to concrete.

PART 2 - PRODUCTS

2.1 GENERAL FLOORING ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 - 1. Ardex Americas, Aliquippa, PA. products "Feather Flash" and "Ardex SD-P".
 - 2. Quikrete Companies., Atlanta, GA., product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., Ayer MA., product "Profinish".
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
 - 1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
 - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
 - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - c. VOC content: Less than 50 g/L.
 - 2. Acceptable manufacturers, or approved equal:
 - a. Advanced Adhesive Technology, Inc, Dalton GA.
 - b. DAP Incorporated, Dayton OH.
 - c. W.W. Henry Company, Aliquippa PA.
 - d. Roberts Consolidated Industries, Inc., City of Industry, CA.
 - e. Or adhesive recommended by flooring manufacturer for performance and compliance with warranty requirements.
- C. Temporary Floor Protection: Flame retardant treated in conformance with NFPA 701. Acceptable Products include the following, or approved equal:
 - 1. Holland Manufacturing, Succasunna NJ., product: "Blue Shield Flame StopR."
 - 2. Pro Tect Associates, Northbrook, IL, product "Traffic Guard."
 - 3. Protection from the Ground Up, Escondido, CA., product "Deck Cover FR."
 - 4. Surface Shields, Orland Park, IL, product "Cover Shield."
- D. Transition and edge strips:
 - 1. General: Rubber or profiles required for thickness of abutting materials.
 - 2. Edge strips: Tapered or bull nose edge.

3. Colors: Match or contrast with the flooring, as selected by the Architect from standard colors available, of width shown on the drawings.

2.2 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
 - a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
 1. pH test paper.
 2. Distilled or de ionized water.

2.3 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.4 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
1. Substrates shall be dry and clean.
 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
 3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual resilient flooring Specification Sections included as part of this Filed Sub-Bid.
 4. Temperature of resilient flooring and substrate shall be within specified tolerances.
 5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete:
1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
 2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
 3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
 4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

3.2 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.

- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

3.3 TESTING IN SITU CONCRETE SUBSTRATES

A. Scope:

- 1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
 - a. Existing building suspended slabs may be excluded from this requirement.

B. Scheduling:

- 1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
- 2. In the event new flooring is to be installed over existing resilient flooring, remove the portion of the existing flooring and adhesive directly under the area where testing will be conducted. Patch flooring to match existing construction after completion of testing.

C. Test result submittals:

- 1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
- 2. List test locations on chart and show same on marked up Floor Plan Drawings.
- 3. Submit results in duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.

D. Testing Procedures, quantification of Relative Humidity

- 1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
- 2. The number of in situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
- 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:

-
- a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
 6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.
- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be included with the test report.
 2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Test sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
 4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
 5. Expose Calcium Chloride and set dish on concrete surface.
 6. Install test containment dome and allow test to proceed for 60 to 72 hours.
 7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
 8. Weigh test dish on site recording weight and stop time.
 9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."
- F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:
1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.

- b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
 2. Record and report results.
- G. Testing Procedures:
 1. Initial testing: Provide 3 tests for the first 1,000 square feet.
 2. Add one test for each additional 1,000 square feet.
 3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
 4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
 5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
 6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
 7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

3.4 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
 1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
 2. Remove, by light sanding and grinding, all protruding edges, high spots.
 3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
 5. For concrete substrates:
 - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.

- b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.
- C. Removal of existing coatings and adhesives:
 - 1. Painted flooring substrates: Remove all existing coatings on flooring substrates. Certain paints may contain lead. Conform to federal, state and local laws regarding appropriate methods for identifying lead-based paint and removing such paint, and notify Owner if lead-based paint has been identified.
 - a. Remove existing visible lead-based paint in compliance with applicable regulations and requirements of governing agencies having jurisdiction
 - b. Isolate work areas from other workers of this project, provide air sampling results and worker exposure samples as required by referenced regulations. Contractor is responsible for worker safety and environmental exposure of contaminants during the performance of this Work.
 - c. Remove all paint chips and debris using HFOA vacuums. Dispose of caustic waste, paint chips in compliance with Resource Conservation and Recovery Act (RCRA) and all other EPA, state and local authority requirements as might be applicable.
 - 2. In situ adhesive on flooring substrates: Use of commercial adhesive removers may adversely affect the bonding of a new flooring covering. Comply with The Resilient Floor Covering Institute (RFCI) publication "*Recommended Work Practices for Removal of Resilient Flooring Coverings*" and flooring product manufacturer's written instructions and technical advisories for removal of existing adhesives, so substrate is acceptable for new flooring installation and warranty.
 - 3. In situ asphalt-based adhesive on flooring substrates: Contact flooring product manufacturer's technical representative to obtain instructions for removal of existing asphalt-base adhesives so substrate is acceptable for new flooring installation and warranty.
- D. Protection of In-situ Conditions: During the operation of work of this Filed Sub-bid, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Filed Sub-bid, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- E. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- F. Apply primers as recommended by adhesive manufacturer's written instructions.
- G. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

3.5 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
 - 1. Apply primers as recommended by adhesive manufacturer's written instructions.

3.6 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect/Engineer.

3.7 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
 - 1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.

3.8 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with heavyweight kraft paper and overlay with red-rosin paper, taping the edges to maintain position of the protection paper. Reapply papers as required to maintain floor protection.

End of Section

SECTION 09 00 09
PAINTING FILED SUB-BID REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section is work of a Publicly Bid Trade Contractor and includes the following requirements.
1. Specification requirements for the Trade Contract "PAINTING" includes all work of the following listed Specification Sections, in their entirety:
 - a. Section 03 05 13 – CONCRETE SEALERS.
 - b. Section 09 00 09 - PAINTING FILED SUB-BID REQUIREMENTS.
 - c. Section 09 91 00 – PAINTING.
 - d. Document 09 91 13 - EXTERIOR PAINTING SCHEDULE.
 - e. Document 09 91 23 - INTERIOR PAINTING SCHEDULE.
 - f. Section 09 96 46 - INTUMESCENT PAINTS.
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None.
- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:

1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A101A, A101B, A101C, A101D, A102, A102A, A102B, A102C,
A102D, A103, A103A, A103B, A103C, A401, A402, A403, A404, A405, A406,
A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421,
A422, A423, A425, A427, A429, A400, A440, A441, A442, A713, A606, A600,
A450, A141A, A141B, A141C, A141D, A142A, A142B, A142C, A143A,
A143B, A143C, A712, A605, A426, A623, A714, A428, A430, A431, A432,
A433, A434, A435, A471, A472, A473, A601, A604, A609, A620, A625, A607,
A720, A721, A470, A460, A461, A700, A602, A621, A650, A651, A652, A690,
A453, A451, A452, A603, A104, A300, A301, A570, A490, A002, A463, A560,
A710, A711, A622, A715, A200, A211, A201, A212, A202, A213, A203, A214,
A204, A215, A205, A230, A311, A312, A313, A314, A315, A316, A317, A318,
A319, A320, A321, A322, A513, A520, A521, A522, A523, A524, A530, A531,
A532, A222, A802, A540, A541, A510, A511, A512, A514, A515, A533, A501,
A502, A491, A542, A543, A492, FP001, FP104, P001, A462, L 1.0, L 1.1, L
1.2, L 1.3, L 1.4, L 1.5, L 1.6, L 3.0, A181, A181A, A181B, A181C, A181D,
A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A691,
A111A, A111B, A111C, A111D, A112A, AV000, AV101C, AV101D, AV201C,
AV201D, AV300, AV301, AV303, AV400, AV500, AV501, AV502, AV503,
AV600, AV601, TE000, TE001, TE111, TE112, TE121, TE122, TE141,
TL100, TL111, TL121, TL131, A112B, A112C, A113A, A113B, A113C,
A113D, FP101A, FP101C, FP101D, FP102A, FP102B, FP102C, FP102D,
FP103A, FP103B, FP103C, P101A, P101B, P101C, P101D, P102A, P102B,
P102C, P102D, P103A, P103B, P103C, P103D, M101A, M101B, M101C,
M101D, M102A, M102B, M102C, M102D, M103A, M103B, M103C, M103D,
M201A, M201B, M201C, M201D, M202A, M202B, M202C, M203A,
M203B, M203C, M203D, E001, E101A, E101B, E101C, E101D, E102A,
E102B, E102C, E102D, E103A, E103B, E103C, E103D, E201A, E201B,
E201C, E201D, E202A, E202B, E202C, E202D, E203A, E203B, E203C,
E203D, E401A, E401B, E401C, E401D, E402A, E402B, E402C, E402D,
E403A, E403B, E403C, E403D, E501A, E501B, E501C, E501D, E502A,
E502B, E502C, E502D, E503A, E503B, E503C, E503D, T001, T101A,
T101B, T101C, T101D, T102A, T102B, T102C, T102D, T103A, T103B,
T103C, T103D
 2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
 3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- G. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE

CONTRACTOR: _____

TRADE CONTRACT FOR TRADE: PAINTING.

2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Owner will not be responsible for errors, omissions and/or charges for extra work arising from Trade Contractor's failure to familiarize themselves with the Contract Documents and existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all schedules and submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect and OPM, in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.

3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.
- 2.2 HOISTING MACHINERY AND EQUIPMENT
- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 09 05 60
COMMON WORK RESULTS FOR FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This Section includes general requirements for flooring preparation, installation and temporary protection for flooring systems provided under the General Construction Contract.
 - 1. Provide independent testing laboratory services to perform relative humidity, moisture vapor emission, and pH tests on in situ concrete slabs, which shall be in addition to testing as may be performed by Owner.
 - 2. Prepare substrates to receive resilient tile flooring as required to ensure specified tolerance level for finish surface of floor tile. Preparation work includes patching, smoothing and leveling substrate, including:
 - a. Grinding down high spots of substrate.
 - b. Providing Portland cement-based latex underlayment (filler).

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 05 13 – CONCRETE SEALERS.
- D. Section 03 33 00 – CAST-IN-PLACE CONCRETE: Concrete floor slab substrate.
- E. Section 03 54 00 – CAST UNDERLAYMENT.
- F. Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS: General requirements for preparation, installation and temporary protection for flooring work which is included as part of the Resilient Flooring Filed Sub-Bid.
- G. Section 09 63 40 - STONE FLOORING.
- H. Section 09 64 29 - WOOD STRIP AND PLANK FLOORING.

- I. Section 09 64 33 - LAMINATED WOOD FLOORING.
- J. Section 09 64 66 - WOOD ATHLETIC FLOORING.
- K. Section 09 67 23 - RESINOUS FLOORING.
- L. Section 09 68 00 - CARPETING: Carpet and transition strips.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM D 4259 - Standard Practice for Abrading Concrete.
 - 2. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 3. ASTM E 1907 - Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
 - 4. ASTM F-710 - Preparing Concrete Floors to Receive Resilient Flooring.
 - 5. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 6. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In-Situ Probes
 - 7. ASTM F 3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings.
 - 8. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate flooring work with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-Installation Meetings: At least 30 calendar days prior to commencing any flooring work, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 - 1. Required attendees:
 - a. Owner.
 - b. Architect.

- c. General Contractor.
 - d. Project Superintendents representing each floor system installer.
 - e. Manufacturer's technical representative(s) for flooring products as designated by Architect or Contractor.
 - f. Representatives of related trades as directed by the Architect or Contractor, and representatives for installers of flooring work specified under Article 1.2 RELATED REQUIREMENTS
2. Agenda:
- a. Scheduling of preparation and flooring operations.
 - b. Procedures for testing of relative humidity and moisture content of in situ substrates.
 - c. Water vapor emission control methods.
 - d. Review of staging and material storage locations.
 - e. Coordination of work by other trades.
 - f. Protection of completed Work.
 - g. Establish humidity and temperature limitations for performing the work, to which Architect and Contractor must agree.
 - h. Discuss process for inspection and acceptance of completed Work of this Section.
- C. Sequencing:
1. Sequence work to ensure flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
 2. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
 3. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Test and Evaluation Reports: Include the following:
 - a. Report the test deployment parameters at start of testing and finishing of testing:
 - 1) Start and finish dates and times of testing.
 - 2) Ambient temperature.
 - 3) Ambient relative humidity and dew point temperature.
 - 4) Minimum and maximum ambient temperature and relative humidity reached during testing.
 - b. Report the "factor" used to calculate the actual test area of the calcium chloride test site.

- c. Report the concrete slab thickness (in inches).
 - d. Report all test results in chart form listing the following:
 - 1) Test locations (also mark test locations on floor plan).
 - 2) Surface temperature of concrete.
 - 3) pH paper/ pencil reading (ASTM F 710).
 - 4) Visual appearance of concrete.
 - 5) Concrete slab age.
 - 6) Relative humidity in concrete, % (ASTM F 2170):
 - a) Depth of hole from top of slab, inches.
 - b) RH in concrete, %.
 - c) Temperature in concrete, °F.
 - 7) Surface moisture meter test (ASTM E 1907):
 - a) Electrical impedance test values.
 - b) Electrical resistance test values.
 - 8) Moisture vapor emission (MVER) - CaC12 test (ASTM F 1869):
 - a) Weight gain in grams.
 - b) Exposure time/hours.
 - c) MVER Lbs/1000 sq. ft./24 hours.
 - e. Report all unacceptable substrate and field conditions observed during testing.
- B. Submit 1 copy of test data to the installers of all flooring materials or floor surface coating materials scheduled to be installed.

1.7 QUALITY ASSURANCE

- A. General: perform relative humidity, moisture vapor emission (MVER) and acidity/alkalinity (pH) Testing for concrete slabs and floors.
- 1. General Contractor shall employ and pay for services of an independent testing laboratory to perform relative humidity, moisture vapor emission, and pH tests on concrete slabs as follows. The test shall be witnessed by the Contractor, flooring subcontractors and Owner's Project Representative.
 - a. Relative Humidity, Moisture Vapor Emission and pH Testing on all concrete slabs over-which a finished floor is to be installed. This includes, but is not limited to:
 - 1) Resinous flooring and seamless flooring of all types.
 - 2) Painted floors and concrete sealers.
 - 3) Carpet.
 - 4) Wood flooring of all types.
 - 5) Terrazzo (excluding sand-bed terrazzo systems).
 - b. Perform moisture and pH tests on all concrete floors over-which stone flooring is to be applied.
 - 2. Testing Requirements: As specified under Part 3 of this Section.
 - a. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products.

- 1) Perform additional testing after procedures have been performed by the General Contractor to reduce moisture content to ratings acceptable to the various flooring and floor-coating manufacturers. General Contractor's procedures to reduce moisture content may consist of project dehumidification and temporary heating, environmental controls, or moisture mitigation treatment to concrete.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 GENERAL FLOORING ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 1. Ardex Americas, Aliquippa, PA., products "Feather Flash" and "Ardex SD-P".
 2. Quikrete Companies., Atlanta, GA., product "Fast-Set Underlayment 1248".
 3. Silpro Corp., Ayer MA., product "Profinish".
- B. Adhered flooring systems general requirements for adhesives (except as otherwise specified in individual Specification Sections):
 1. General Flooring Adhesives: High moisture resistant and alkali resistant adhesive: Synthetic Polymer, non-flammable in wet state, with NFPA, Class A rated, VOC compliant, capable of withstanding the following in continuous service:
 - a. Up to 90% relative humidity when measured in accordance with ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.
 - b. Up to 8 lbs./1000 sq. ft./ 24 hours MVER when measured in accordance with ASTM F1869 - Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - c. VOC content: Less than 50 g/L.
 2. Acceptable adhesives, include the following, or approved equal, (subject to acceptance of flooring manufacturer for performance and compliance with warranty requirements, for each type of floor system specified):
 - a. Advanced Adhesive Technology Inc., Dalton GA.
 - 1) Adhesive: "AAT-270" (maximum 80% RH / 3 pounds MVER).
 - 2) Adhesive: "AAT-675" (maximum 85% RH / 5 pounds MVER).
 - b. Armstrong World Industries, Inc., Flooring Division, Lancaster PA., adhesive: "S-515" (maximum 90% RH / 5 pounds MVER).
 - c. DriTac Corp., Clifton NJ., adhesive: "5900 Mega Bond" (maximum 90% RH / 8 pounds MVER).
 - d. W.W. Henry Company, Aliquippa PA.
 - 1) Adhesive: "640 Vinyllock" (maximum 90% RH / 3 pounds MVER).

- 2) Adhesive: "430 ClearPro" (maximum 90% RH / 8 pounds MVER).
 - e. Johnsonite, Middlefield OH., adhesive: "SpraySmart" (maximum 90% RH / 8 pounds MVER).
 - f. Mapei Corporation, Elk Grove IL:
 - 1) Adhesive: "Ultrabond ECO 360" (maximum 80% RH / 5 pounds MVER).
 - 2) Adhesive: "Ultrabond ECO 711" (maximum 95% RH / 8 pounds MVER).
 - g. Roberts Consolidated Industries, Inc., City of Industry, CA., adhesive: 7350 (maximum 90% RH / 10 pounds MVER).
 - h. Titebond, Columbus, OH., adhesive "Titebond 670 Resilient Flooring Adhesive" (maximum 90% RH / 8 pounds MVER).
- C. Temporary Floor Protection: Flame retardant treated in conformance with NFPA 701. Acceptable Products include the following, or approved equal:
- 1. Holland Manufacturing, Succasunna NJ., product: "Blue Shield Flame StopR."
 - 2. Pro Tect Associates, Northbrook, IL, product "Traffic Guard."
 - 3. Protection from the Ground Up, Escondido, CA., product "Deck Cover FR."
 - 4. Surface Shields, Orland Park, IL, product "Cover Shield."

2.3 TESTING EQUIPMENT

- A. For relative humidity testing: Digital Meter and Calibrated Humidity and Temperature probe kit in Compliance with ASTM F 2170.
 - a. Minimum 2 point probe calibration.
- B. For calcium chloride testing: Anhydrous calcium chloride testing in accordance with Rubber Manufacturer's Association (RMA) Test requirements and in compliance with ASTM F 1869.
- C. For pH testing: In compliance with ASTM F710.
 - 1. pH test paper.
 - 2. Distilled or de ionized water.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that spaces to receive flooring finishes are suitable for installation. Do not proceed with work until unsatisfactory conditions are corrected. Comply with manufacturer's recommendations including the following:
 - 1. Substrates shall be dry and clean.
 - 2. Substrates shall be free of depressions, raised areas, or other defects which would telegraph through installed flooring.
 - 3. Verify concrete substrates have a flat tolerance of 3/16" in 10 linear feet, or more restrictive tolerances as specified under individual flooring Specification Sections.

4. Temperature of flooring and substrate shall be within specified tolerances as required by flooring and adhesive manufacturers.
 5. Moisture condition and adhesive bond tests shall be performed as specified herein.
- B. For applications on concrete:
1. Verify concrete substrate has been cured and is sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture test
 2. Verify curing, hardening, or breaking compounds have not been used. If there are any, do not proceed until compounds have been removed as specified.
 3. For applications on concrete slab on grade or below grade, verify vapor barrier below slab was installed. If no vapor barrier was installed, do not proceed with work unless written acceptance of such conditions is received and submitted.
 4. Perform testing of in situ concrete, relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings as specified herein. Do not proceed with work until results of moisture condition tests are acceptable.

3.2 SURFACE PREPARATION FOR TESTING

- A. General: Substrates shall be dry and clean. Remove all dirt, debris, sealers, coatings, finishes, film-forming curing compounds, and other substances which may affect the rate of moisture dissipation. Remove all dust by vacuum or other methods. Do not use chemicals of any kind to clean concrete.
1. Non- chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in ASTM D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing.
- B. To test for pH at the surface of a concrete slab, use care not to over abrade the surface of the concrete which can result in overstated pH readings.

3.3 TESTING IN SITU CONCRETE SUBSTRATES

- A. Scope:
1. Provide in situ concrete relative humidity and surface pH testing to all concrete slabs specified to be covered with floor coverings or resinous coatings. Includes concrete placed as part of this Work which occurs below grade, above grade (suspended slabs), and slabs on grade.
- B. Scheduling:
1. Testing shall take place after allowing concrete to dry for a minimum of 90 days. Testing to be scheduled no less than one, nor more than three weeks prior to scheduled flooring installation.
 - a. DO NOT conduct testing unless the slab environment is identical to that in which the finished flooring is to be installed.
- C. Test result submittals:

1. Report all test results in chart form listing test dates, time, depth of test well, in situ temperature, relative humidity, moisture vapor and pH levels.
 2. List test locations on chart and show same on marked up Floor Plan Drawings.
 3. Submit results In duplicate. Deliver copies directly to Architect, Owner's Project Representative and General Contractor.
- D. Testing Procedures, quantification of Relative Humidity
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F), and 50 percent (plus or minus 10 percent) relative humidity. When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording conditions during the test period. A transcript of this information must be Included with the test report.
 2. The number of In situ relative humidity test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
 3. Drill test holes utilizing a roto hammer drill. Hole diameter shall not exceed outside diameter of the insertable test sleeve by more than 0.04 inch (1mm). Drilling operation must be dry. Do not use water for cooling or lubrication; do not wet-core test hole. Determine the thickness of the concrete slab from Construction Documents. Depths of test holes shall be as follows:
 - a. For elevated slabs (not poured in pans): Drill test holes to a depth equal to 20 percent of the concrete thickness.
 - b. For slabs on grade and elevated slabs in pans: Drill test holes to a depth equal to 40 percent of the concrete thickness.
 4. Vacuum all concrete dust from test hole.
 5. Insert a hole liner, or sleeve, to the full depth of test hole, assuring that the liner is capped or plugged at the end protruding from the concrete surface.
 6. Permit the test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.
 7. Remove the sleeve plug and place a probe into the sleeve assuring that it reaches the bottom of the test hole.
 8. Allow the probe to sit in the test sleeve for 30 minutes before taking readings.
 9. Read and record temperature and relative humidity at the test site.
- E. Testing Procedures, quantification of concrete moisture vapor emission through Calcium Chloride Testing:
1. The test site should be maintained at the same temperature and humidity conditions as those anticipated during normal occupancy. These temperature and humidity levels should be maintained for 48 hours prior and during test period. If meeting this criteria is not possible, then minimum conditions should be 75 degrees F (plus or minus 10 degrees F) and 50 percent relative humidity (plus or minus 10 percent). When a building is not under HVAC control, a recording hygrometer or data logger shall be in place recording

conditions during the test period. A transcript of this information must be included with the test report.

2. The number of vapor emission test sites is determined by the square footage of the facility. The minimum number of tests to be placed is equal to 3 in the first 1,000 square feet and 1 per each additional 1,000 square feet.
3. Test sites are to be cleaned of all adhesive residue, curing compounds, paints, sealers, floor coverings, and similar materials. 24 hours prior to the placement of test kits.
4. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time.
5. Expose Calcium Chloride and set dish on concrete surface.
6. Install test containment dome and allow test to proceed for 60 to 72 hours.
7. Retrieve test dish by carefully cutting through containment dome. Close and reseal test dish.
8. Weigh test dish on site recording weight and stop time.
9. Calculate and report results as pounds of emission per 1,000 square feet per 24 hours."

F. Testing Procedures, quantification of Acidity/Alkalinity (pH) Level:

1. At or near the relative humidity test site and each vapor emission (calcium chloride) test site, perform pH test.
 - a. At each testing site, lay down a loose 2 foot by 2 foot sheet of non perforated sheet backed by plywood. Leave in place for 48 hours.
 - b. Remove sheet and place several drops of distilled or de ionized water onto the concrete surface to form a puddle approximately 1 inches in diameter.
 - c. Allow the water to set for approximately 60 seconds.
 - d. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading
2. Record and report results.

G. Testing Procedures:

1. Initial testing: Provide 3 tests for the first 1,000 square feet.
2. Add one test for each additional 1,000 square feet.
3. Concrete surface area to be tested shall be completely clean as specified herein under Preparation.
4. Perform moisture tests in strict accordance with the kit manufacturer's Instructions. Moisture tests shall remain undisturbed for 60 to 72 hours.
5. Immediately after moisture test has been removed from test area, conduct pH test in area previously covered by plastic dome of moisture test kit.
6. After completion of tests submit 2 copies of test data to the Architect. Submit a copy of the test data to all installers of flooring materials and resinous flooring materials scheduled to be installed.
7. Provide additional testing in the event test results indicate higher moisture content than recommended by the flooring material and coating material manufacturers for the installation of their products. Perform such additional

testing, at no additional cost to the Owner, after procedures have been performed to reduce moisture content to ratings acceptable to the various flooring and coating manufacturers.

3.4 FLOORING PREPARATION – GENERAL REQUIREMENTS

- A. Close spaces to pedestrian and worker traffic during the installation of the flooring.
- B. General: Comply with ASTM F 710 and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.
 - 1. Fill voids, cracks, and depressions with trowel-applied leveling compounds acceptable to manufacturer. Remove projections and repair other defects to tolerances acceptable to manufacturer.
 - 2. Remove, by light sanding and grinding, all protruding edges, high spots.
 - 3. Ensure substrate is flat to a plus or minus 1/8 inch in 10 feet tolerance. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
 - 4. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter.
 - 5. For concrete substrates:
 - a. Concrete floors with steel troweled (slick) finish shall be properly roughened up (sanded) to ensure suitable adhesion.
 - b. Concrete floors with curing, hardening, and breaking compounds shall be abraded with mechanical methods only to remove compounds. Use blastrac or similar equipment.
- C. Protection of In-situ Conditions: During the operation of flooring work, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- D. Use HEPA Vacuum to clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring. Perform vacuuming immediately prior to installation.
- E. Apply primers as recommended by adhesive manufacturer's written instructions.
- F. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum, and as additionally required under individual Specification Sections.

3.5 FLOORING INSTALLATION GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
 - 1. Apply primers as recommended by adhesive manufacturer's written instructions.

3.6 ADHESIVE BOND TESTING

- A. Use the specified flooring and recommended adhesive, install approximately 36 by 36 inch sized flooring as specified under individual flooring specification sections. Install test samples approximately 50 feet apart throughout the area, but not less than 1 test per 1000 square feet. Areas next to walls or other light traffic areas should be selected for the bond test. Tape down the perimeter of the flooring to prevent drying of the adhesive at the edges. After a minimum period of 72 hours the flooring should be pulled from the subfloor. If an unusual amount of force is required, the bond could be considered sufficient. Floors demonstrating unsuitable bond to substrate require modifications to flooring installation and may require application of moisture mitigation products. Review all conditions with Architect/Engineer.

3.7 PROTECTION

- A. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with fire-resistant temporary floor protection, taping the edges to maintain position of the protection paper. Reapply protection materials as required to maintain floor protection.

End of Section

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Section 09 21 17
SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of vertical and horizontal shaft wall assemblies where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install shaft wall systems including framing, liner and board finish components.
 - 1. Gypsum Board taping and finishing are specified under Section 09 29 00 – GYPSUM BOARD.
- C. Install access panels occurring in shaft walls, furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- D. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Supplemental wood blocking.
 - 2. Installation of metal door frames in shaft wall systems.
- E. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- F. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition and ceiling framing and furring.

- G. Section 09 29 00 - GYPSUM BOARD: Gypsum board finishes, applied over work of this Section 09 22 17, including: joint treatment, joint compound finishing and related trim components.
- H. Section 09 81 00 – ACOUSTICAL INSULATION: Acoustical batt insulation.
- I. Section 09 91 00 - PAINTING: Applied finish coatings.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
 - 2. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
 - 3. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 4. ASTM C 1047 - Accessories for Gypsum wall board and veneer base.
 - 5. ASTM C 1396 - Gypsum Wallboard.
 - 6. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 7. ASTM E 119 - Fire Tests of Building Construction and Materials.
 - 8. GA 201 - Gypsum Board for Walls and Ceilings.
 - 9. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish, Glass Mat and Fiber-Reinforced Gypsum Panels.
 - 10. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
 - 11. All applicable federal, state and municipal codes, laws and regulations for fire rated assemblies.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
 - 2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD, to assure the steady progress of the Contract.
- B. Sequencing: Do not install shaft wall until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings:
 - a. Details of any special conditions associated with fireproofing.
 - b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
 - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
 1. Store materials inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - a. Neatly stack board materials flat to prevent sagging.
 2. Handle board materials so to prevent damage to edges, ends and surfaces.
 3. Protect metal trim accessories and corner beads from being bent or damaged.
- C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including plaster materials in packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.8 SITE CONDITIONS

- A. In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Metal components and related items:
 - a. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
 - b. MarinoWare, Division of Ware Industries, South Plainfield, NJ.
 - c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
 - d. Telling Industries, Mentor, OH.

- e. United States Gypsum Company (USG), Chicago, IL.
- 2. Gypsum liner panels and board materials:
 - a. United States Gypsum Company (USG), Chicago, IL.
 - b. National Gypsum Company, Charlotte, NC.
 - c. Georgia-Pacific Gypsum, LLC, Atlanta, GA.
 - d. Continental Building Products, Hendron, VA.
- 3. Deflection track components and related items:
 - a. Cemco Steel Framing and Metal Lath, City of Industry, CA.
 - b. Clarkwestern Dietrich Building Systems, LLC, Schiller Park, IL.
 - c. Delta Star, San Carlos, CA.
 - d. Marino\Ware, Division of Ware Industries, South Plainfield, NJ.
 - e. Metal-Lite Inc., Crossville, TN
 - f. Telling Industries, Mentor, OH.
 - g. The Steel Network, Inc., Durham, NC.

- B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

A. Regulatory Requirements:

- 1. Fire resistance ratings: Provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters
- 2. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 MATERIALS

- A. Studs for shaft wall assemblies: 20 gage (0.0329 inch [0.84 mm] minimum thickness), galvanized and complying with ASTM C 645, 2-1/2 inch size, or as indicated otherwise in the drawings.
 - 1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (table 1). Equivalent coatings (G40e) will not be considered equal.
 - 2. Acceptable products include the following, or approved equal:

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- a. Clarkwestern Dietrich Building Systems, LLC, West Chester, OH, product, "C-T Stud".
 - b. Marino\Ware, Division of Ware Industries, South Plainfield, NJ, product: "CT-Stud".
 - c. Cemco Steel Framing and Metal Lath, City of Industry, CA, product; "C-H Studs".
 - d. Telling Industries, Mentor, OH, product; "C-T Stud".
 - e. United States Gypsum Company (USG), Chicago, IL, product, "C-H Studs".
- B. Runners for studs in shaft wall assemblies: J-track, galvanized and complying with ASTM C 645, with 2-1/4 inch leg, in size, gage and manufacturer to match shaft wall studs.
- C. Struts for jamb framing of door openings in shaft wall assemblies: J-type strut, galvanized and complying with ASTM C 645, 20 gage (0.0329 inch [0.84 mm] minimum thickness), with minimum 3 inch return.
- D. Shaftwall liner: UL fire resistance rated, ASTM C 1658 – Glass-Matt-Faced Type X board with beveled edges, 1 inch thick, 24 inches wide, of lengths to minimize end joints.
1. Mold Resistance Performance per ASTM D 3273: Score 10 having no mold growth in a 4 week laboratory controlled test.
 2. Acceptable products include the following, or approved equal:
 - a. United States Gypsum Company (USG) Sheetrock Brand product; "Glass-Mat Liner Panels".
 - b. National Gypsum Company, Gold Bond Brand product; "eXP Extended Exposure Shaftliner".
 - c. Georgia-Pacific Gypsum, LLC, product; "DensGlass Shaftliner".
 - d. Continental Building Products, product; "Weather Defense Platinum Shaftliner Type X".
- E. Gypsum board types: Specified under Section 09 29 00 – GYPSUM BOARD.

2.5 ACCESSORIES

- A. Finishing trim, joint tapes, compound and accessories: Specified under Section 09 29 00 – GYPSUM BOARD.
- B. Fasteners:
1. Shaft wall framing:
 - a. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
 - b. Concrete stub nails for securing runners to concrete.
 - c. №.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
 2. Board fasteners: In compliance with ASTM C954 or ASTM C1002, of head type, thread, point and finish as recommended by the shaft wall system manufacturer.

- C. Joint Sealers (Acoustical Sealant): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable. Acceptable products include the following, or approved equal.
 - 1. Tremco, Beachwood, OH. product, "Acoustical Sealant".
 - 2. United States Gypsum Company, Chicago, IL. product, "USG Acoustical Sealant".
 - 3. Pecora Corporation, Harleysville PA, product, "AC-20 FTR".

2.6 SOURCE QUALITY CONTROL

- A. Obtain shaft wall products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of shaft wall system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION - GENERAL

- A. Erect shaft wall systems in strict accordance with the manufacturers' UL listed test construction for the required fire rating and in strict accordance with manufacturer's instructions, ASTM C 754 for Metal Framing, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Install supplementary framing in shaft-wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft-wall assembly framing.
 - 1. Where handrails directly attach to shaft-wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
 - 2. Integrate stair hanger rods with shaft-wall assemblies by locating cavity of assemblies where required to enclose rods.

3.3 INSTALLATION OF SHAFT WALL

- A. Install J runners or E studs at floor and ceiling structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
 - 1. Install runners and studs prior to fireproofing.
 - 2. Do not splice studs, all studs shall extend from the floor to the underside of the structure above in one single length.
- B. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with one screw per flange.

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1. Where studs are installed directly to exterior masonry walls, install 15 pound asphalt felt between stud and wall.
 - C. Install studs 3/8 inch to not more than 1/2 inch less than opening height and install between liner panels with liner inserted in the groove. Install full-length steel "E" studs over shaft wall liner at T-intersections, corners, columns and both sides of closure panels. Frame openings cut within a liner panel with "E" studs around perimeter. For openings, frame with vertical "E" studs at edges, horizontal J-strut at head and sill, and reinforcing as recommended by the shaft wall manufacturer. Suitably frame all openings to maintain structural support for wall.
 - D. Furnish and install additional cross bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.
 1. At penetrations in shaft wall, maintain fire-resistance rating of shaft-wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices and similar items.
 - E. Cut liner board panels 1 inch less than opening height and erect vertically between J-runners. Where shaft walls exceed 14 feet in height, position liner panel end joints within upper and lower third points of wall. Stagger joints top and bottom in adjacent panels.
 1. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
 - F. Erect fire rated gypsum panel base layer horizontally on one side of studs with end joints staggered. Fasten base layer to studs with 1 inch, Type S-12 screws. Caulk perimeter of base layer panels.
 - G. Apply fire rated gypsum panels face layer vertically over base layer with joints staggered and attach with 1-5/8 inch Type S-12 screws staggered from those in base, spaced 12 inches on center and driven into studs.
 - H. Finish boards, trim and joint compound finishing as specified under Section 09 29 00 – GYPSUM BOARD.

3.4 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.
 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.

- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
 - 1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
 - 2. Apply sealant in continuous beads without open joints, voids or air pockets
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 - 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.5 APPLICATION OF JOINT TREATMENT

- A. Application of joint tape and compound finishing is specified under Section 09 29 00 – GYPSUM BOARD.

3.6 TOLERANCES

- A. Install shaft wall partitions with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.

End of Section

Section 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of non-load bearing metal framing for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install:
 - 1. Metal furring and framing where indicated on the Drawings, including cross bracing and knee bracing.
 - 2. Flexible track assemblies for curved walls.
 - 3. Metal ceiling and soffit framing, including hanger attachments, sound isolation accessories, wire hangers, and screwable metal tee grid system.
 - 4. Reinforcing plate blocking.
 - 5. Deflection track assemblies at tops of metal stud partitions.
 - a. Provide fire-rated assemblies at fire-rated, corridor, and smoke partitions.
 - b. Provide non fire-rated assemblies at all other partitions.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- D. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking and framing, where indicated.
 - 2. Installation of metal door frames in gypsum board work.
- E. Section 07 21 00 - THERMAL INSULATION.

- F. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
- G. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- H. Section 09 21 17 – SHAFT WALL ASSEMBLIES: Framing supporting shaft wall assemblies, and fire-resistant liner panels.
- I. Section 09 29 00 - GYPSUM BOARD: Gypsum board, applied over metal framing installed by this Section 09 22 16 including: gypsum board, and related trim components.
- J. Section 09 51 00 - ACOUSTICAL CEILING: Suspended acoustical tile ceiling, including related metal suspension system.
- K. Section 09 81 00 – ACOUSTICAL INSULATION: acoustical batt insulation between framing.
- L. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
- M. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM C 525 - General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process..
 - 2. ASTM C 645 - Non-Load Bearing Steel Studs, Runners, and Rigid Furring Channels for Screw Application of Gypsum Board.
 - 3. ASTM C 646 - Steel Drill Screws for the Application of Gypsum Sheet Material to Light Gage Steel Studs.
 - 4. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Wallboard.
 - 5. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
 - 6. ASTM E 119 - Fire Tests of Building Construction and Materials.
 - 7. GA 203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum board.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
-

1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work
2. Work of this Section shall be closely coordinated with the work of Section 09 29 00 - GYPSUM BOARD to assure the steady progress of the Contract.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
- C. Sole Source: Obtain products required for the Work of this Section from a single manufacturer.
- D. Qualifications:
 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, surface contamination, corrosion and damage from construction operations and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Metal components and related items (including non-rated deflection track assemblies):

- a. ClarkDietrich Building Systems, LLC, West Chester, OH.
 - b. MarinoWare, Division of Ware Industries, South Plainfield NJ.
 - c. Cemco Steel Framing and Metal Lath, City of Industry, CA.
 - d. Telling Industries, Willoughby, OH.
 - e. Super Stud Building Products, Inc., Edison NJ.
2. Fire rated deflection track assemblies:
 - a. Cemco Steel Framing and Metal Lath, City of Industry, CA.
 - b. ClarkDietrich Building Systems, LLC, West Chester, OH.
 - c. Fire Trak Inc., Watkins, MN.
 - d. Metal-Lite Inc., Crossville, TN
 - e. The Steel Network, Inc., Durham, NC.
 3. Suspended furring system for ceilings and soffits:
 - a. Armstrong World Industries, Inc., Lancaster, PA.
 - b. Chicago Metallic Corporation, Chicago IL.
 - c. USG Corporation, Chicago IL.
- B. The design and details as shown on the drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.2 DESCRIPTION

- A. Regulatory Requirements
1. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
 - a. Fire-Test-Response Characteristics: Provide components that comply with rating requirements specified for fire-rated assemblies under UL 2079 for non-load bearing wall systems.
 - 1) Deflection Clips and Firestop Track: Connections and/or top runner provided in fire-resistance-rated assemblies shall be certified by UL 2079 for cyclic movement requirements.
- B. Sustainability Requirements:
1. Recycled content of Steel: Use maximum available percentage of recycled steel. Steel framing products incorporated into the work shall contain not less than 30 percent of recycled steel.

2.3 FRAMING MATERIALS

- A. "Hat shaped" Furring channels: 7/8 x 2-3/4 inch, roll-formed, hat-shaped, furring channel 25 gage hot-dip galvanized steel conforming to ASTM C 645.
- B. Resilient furring channels: Roll-formed, hat-shaped, 1/2 x 2-5/8 inch, 26 gage hot-dip galvanized steel conforming to ASTM C 645, with pre-punched holes, equal to Dietrich Industries, Inc., Pittsburgh PA, Metal Channel "RC1".
- C. Furring channels: 'Z-shaped' 1-1/2 inch depth, roll-formed, 25 gage (0.179 inch [0.45 mm] minimum thickness), hot-dip galvanized steel.
- D. Studs: 'C-shaped' screw studs, hot-dip galvanized steel complying to ASTM C 645, 20 gage-equivalent (nominal 0.02 inches [0.75 mm] factory ribbed and/or embossed for performance equivalent to 20 gage (0.0329 inch [0.84 mm] minimum thickness studs), of widths indicated on the Drawings.
 - 1. Framing members shall have a G-40 (hot-dipped galvanized) minimum protective coating conforming to ASTM A653 and ASTM A1003 (Table 1), or approved "G40EQ" equivalent coating.
 - 2. Acceptable products include the following or approved equal:
 - a. ClarkDietrich Building Systems, LLC, product "ProStud20" series.
 - b. MarinoWare, Division of Ware Industries, product: "ViperStud Viper20".
 - c. Cemco Steel Framing and Metal Lath, product; "ViperStud Viper20".
 - d. Telling Industries, product; "ViperStud".
 - e. Super Stud Building Products Inc., product: "Edge EQ, EDS20P".
 - 3. Provide full 20 gage (0.0329 inch [0.84 mm] minimum thickness studs where required under the indicated UL assemblies to meet fire resistance ratings.
- E. Runners for metal studs: 'U-shaped' hemmed, hot-dip galvanized steel track conforming to ASTM C645, of gage and width to match respective stud sizes, or heavier gage per design requirements, having 1-1/4 inch leg, provided at tops and bottoms of all studs and at heads of all openings in stud partitions.
- F. Internal reinforcement for various stud conditions, and bracing as required: 10 gage, minimum, galvanized steel.
- G. Furnish cross bracing and knee bracing, as required to assure a completely rigid assembly on metal stud partitions and furred areas.

2.4 FLEXIBLE TRACK ASSEMBLIES

- A. Non-load bearing flexible header and sill track system for curved wall applications; Flex-Ability Concepts, Edmond, OK, or approved equal, products:
 - 1. Flex Ability Concepts product "FLEX-C TRAC": Manufacturer's proprietary C- shaped flexible steel track with banded flanges and screw attachments at every flange interval.

2. Flex Ability Concepts product "FLEX-C ANGLE": Manufacturer's proprietary L-shaped flexible steel angle with banded flanges and screw attachments at every flange interval.

2.5 DEFLECTION TRACK ASSEMBLIES

A. Non Fire-Rated Assemblies

1. Deflection Track: Manufacturer's standard top runner with extended flanges designed to prevent cracking of gypsum board applied to interior partitions resulting from deflection of the structure above fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs, and the following configuration.
 - a. Top runner with extended deep flanges that have one of the following: V-shaped offsets that compress, slots 1 inch on center that allow fasteners for stud attachment; 16 gage sliding clip assemblies attached to top track and clipped to stud, or double track systems as required to meet anticipated vertical movement.
2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Cemco Steel Framing and Metal Lath, product; "Slotted Track CST".
 - b. ClarkDietrich Building Systems, LLC, product; "Deep Leg Deflection Track System", "Fast Top Clip", or "DoubleTrack System".
 - c. MarinoWare, Division of Ware Industries, product: "Slotted Track".
 - d. Metal-Lite, Inc., product: "Slotted Track".
 - e. Super Stud Building Products Inc., product: "ITTC 450 Top Track Deflection Clip".
 - f. Telling Industries, product; "ViperTrack Deep Leg Deflection Track".
 - g. The Steel Network, Inc., product; "VertiTrack VT", "VertiTrack VTD", or "VertiClip SLD".

B. Fire-Rated Assemblies: Head of wall dynamic fire rated joint systems for assemblies in compliance with UL 2079 HW-D. Provide clips or deep leg track system including step bushings complying with ASTM C 645 fabricated from steel sheet complying with ASTM A 653 or ASTM A 568. Thickness as indicated for studs, and width to accommodate depth of studs.

1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Cemco Steel Framing and Metal Lath, product; "FAS Track UL Assemblies".
 - b. ClarkDietrich Building Systems, LLC, product; "SLP-TRK Slotted Deflection Track".
 - c. Fire Trak Inc., Watkins, MN, product "Fire Trak", or "Posi Clips"
 - d. Metal-Lite, Inc., product: "Fire Trak".

- e. The Steel Network, Inc., Durham, NC. product; "VertiClip SLD".
 - C. Coordination: Verify with partition schedule on the Drawings to ensure proper depth of flange offsets at various partitions types.
- 2.6 CEILING AND SOFFIT SUSPENSION MATERIALS
- A. Hanger attachments: Galvanized steel hanger eyes, of size and capacity to safely sustain a live load of at least 150 pounds per hanger attachment.
 - B. Hangers: Soft temper, pre-stretched galvanized carbon steel wire, conforming with ASTM A641, with a yield stress load of at least three times design load, but not less than 12 gage.
 - C. Grid system for direct attachment of finish board: Comprised of double web main furring tees, 1 1/2 inches high by 1-3/8 inches flange face by 0.020 inch thick; double web cross tees, 1 1/2 inches high by 15/16 inch flange face by 0.020 inch thick; 0.020 inch thick wall channels, with 1 1/2 inches interior web height; and all splices, clips, and related items. Provide Underwriters Laboratories Label fire-rated assemblies for locations requiring fire-rated ceilings and soffits
 - 1. Chicago Metallic product "system 640 Furring System".
 - 2. Armstrong Word Industries product "Drywall Furring System".
 - 3. Donn (USG) Corporation, Chicago IL., product "USG Drywall Furring System" with DGLW tees.
- 2.7 SOUND-ISOLATING ACCESSORIES.
- A. Sound Isolation Clips (suspended gypsum ceilings): Precompressed rubber isolation hanger; designed for 100 pounds per hanger load capacity.. Size and space hangers as recommended by manufacturer for anticipated ceiling load.
 - 1. LD Peters & Sons, Inc., New Rochelle NY, model ARH-1-40, (in line type).
 - 2. Mason Industries, Inc., Happaugue NY, model WHR 60 series (in line type).
 - 3. Kinetics Noise Control, Inc., Dublin, OH model "AF-100" series (in line type), or Kinetics model "Iso-Grid 105" (direct mount type).
 - 4. Pac International, Wilsonville, OR, model RISC-DC04x2 HD/DD (direct mount type)
- 2.8 ACCESSORIES
- A. Metal sheet plate blocking and bracing, where indicated: galvanized sheet 0.0312 inch thickness (20 gage).
 - B. Fasteners:
 - 1. Expansion-type fasteners for securing vertical concrete and masonry surfaces.
 - 2. Concrete stub nails for securing runners to concrete.
 - 3. N^o.7 by 7/16 inch Pan head self-drilling screw to attach metal framing components.
 - C. Asphalt felt moisture barrier: ASTM D226, No. 15 asphalt saturated roofing felt.
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- D. Reinforcing plates for blocking: 20 gage cold rolled sheet steel, provide minimum 6 inch width, or as otherwise indicated on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION, QUALITY STANDARDS

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 206, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.
- B. Wherever fire-resistive rated assemblies are indicated on the Drawings, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.

3.2 INSTALLATION OF FURRING

- A. Install metal furring channel horizontally, with channels spaced not more than 16-inch on centers , and attaching the channels to the masonry or concrete substrates with expansion type fasteners spaced not more than 8 inches on centers. Shim beneath channels as needed to ensure that a uniform receiving plane is maintained throughout.
- B. Install Z-channel furring vertically, coordinated with width of rigid insulation (specified under Section 07 21 00) at 24-inches on centers , Attach Z-furring to the masonry and concrete substrates with expansion type fasteners spaced not more than 8 inches on centers. Shim beneath channels as needed to ensure that a uniform receiving plane of final finish is maintained throughout.

3.3 INSTALLATION OF PARTITION FRAMING, GENERAL

- A. Install metal runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and intermediate fasteners spaced no greater than 24 inches.
- B. Install metal stud framing with open side facing in same direction, engaging floor and ceiling runners.
 - 1. Stud spacing:
 - a. Typical: 16 inches on-center.
 - b. For abuse-resistant gypsum board finish: 16 inches on-center.
 - c. For cement board substrate to receive tile finishes: 16 inches on-center.
 - d. For partitions supporting wall cabinets and other wall mounted equipment: 12 inches on-center.
 - e. For curved partitions space framing closer together than normal to prevent flat areas between framing members.
 - 2. When necessary to splice studs, nest stud with 8 inch overlap and screw studs together with screws on both flanges.
 - 3. Where studs are installed directly to exterior masonry walls, install asphalt felt between stud and wall.

- C. Install studs in direct contact with all door and window frame jambs, abutting partitions, partition corners and existing construction elements; screw fasten with screw through both flanges of studs and track, top and bottom.
- D. Securely anchor studs to jamb and head anchors of steel door and window frames. Over head of frames and openings in partitions, install a horizontal section of runner with a web flange bent at each end, horizontally and secure to strut studs with two screws in each bent web. Provide cripple studs over wall openings.
- E. Where horizontal studs are used for wall reinforcing or framing, cut pieces of stud and install horizontally between vertical studs. Cope horizontal studs to fit between flanges of vertical studs. Bend ends of horizontal studs or install clip angles in order to secure by screwing to vertical studs.
- F. Furnish and install additional cross bracing and knee bracing and other framing elements, as required to assure a completely rigid assembly on metal stud partitions and furred areas, whether or not such bracing has been indicated on the Drawings, and for proper receipt of items which will be attached to partition surfaces.

3.4 INSTALLATION OF FLEXIBLE TRACK ASSEMBLIES

- A. Install in strict compliance to manufacturer's written instructions.
 - 1. Do not torch cut components.
- B. Fasten flexible track members by welding or screw fastening, as standard with fabricator. Locate mechanical fasteners and install according to manufacturer's instructions with screw penetrating banding at every flange interval and joined members by not less than 3 exposed screw threads.
- C. Install flexible track members in one or multi-piece lengths. Splice flexible track segments by overlapping bands from one flexible track member to another and attaching screwed fasteners at overlapping plates or flange intervals. Screw penetrations of not less than 3 exposed screw threads.
- D. Provide temporary bracing and leave in place until framing is permanently stabilized.
- E. Fasten reinforcement plate over web penetrations that exceed size of manufacturer's standard punched openings.

3.5 INSTALLATION OF DEFLECTION TRACK

- A. Isolate interior metal stud framing and shaft wall framing from building structure to prevent transfer of loading imposed by structural movement due to deflection.
 - 1. Install deflection track top runner in accordance with manufacturer's instructions and as required to attain lateral support and avoid axial loading.
 - 2. Install fire-rated deflection track top runner in accordance with manufacturer's instructions at top of fire-rated, corridor and smoke partitions.

3.6 INSTALLATION OF REINFORCING PLATE BLOCKING

- A. Install steel reinforcing plates in partitions and furred walls for the support of wall mounted objects as follows:
 - 1. Wherever such reinforcing plates are indicated on the drawings.
 - 2. In locations where wall bumpers are to be installed for the protection of wall surfaces from swinging doors. (See Section 08 71 00 - DOOR HARDWARE).
 - 3. All wall mounted casework locations.
 - 4. All markerboard and tackboard locations.
 - 5. All wall mounted acoustical room components.
- B. Secure gage sheet metal reinforcing plates to steel studs with 1-1/4", Type "S" bugle head screws.

3.7 INSTALLATION - CEILING SUSPENSION SYSTEM

- A. Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by, or penetrating work of this section. Re-adjust ceiling suspension system, prior to the installation of the gypsum board and after installation of mechanical and electrical equipment and fixtures by the respective trades.
- B. Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by, or penetrating work of this section. Re-adjust ceiling suspension system, prior to the installation of plaster base and after installation of mechanical and electrical equipment and fixtures by the respective trades.
- C. Install all components of concealed grid system in accordance with the manufacturer's instructions, with current ASTM C 636 requirements, with design and installation of suspended grid system safely sustaining a membrane loading of at least 7.9 pounds per square foot.
- D. Install hangers not more than 24 inches on centers over locations of main tee members. Install hanger wires to hanger attachment with triple twists. Install additional wires as required to provide support for main tees, at intervals not exceeding four feet, wherever main tees must be interrupted in order to install other work and at all other locations as may be directed by the Architect.
- E. Install main tees parallel to long dimension of the area, at spacing not to exceed 48 inches on-center. Secure with hanger wire as the work progresses. Install cross tees as recommended by the system manufacturer, except spacing shall not exceed 16 inches on-center.

3.8 TOLERANCES

- A. Install partition and ceiling framing and furring with a maximum variation from true flatness of 1/8 inch per 10 feet, noncumulative.

End of Section

Section 09 29 00
GYPSUM BOARD

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of gypsum board (drywall) and trim finishes for partitions, ceilings, and soffits, where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install:
 - 1. Taped, compounded and sanded gypsum board finishes.
 - 2. Impact-resistant gypsum board.
 - 3. Extruded aluminum reveal trim.
 - 4. Trim and accessory components related to gypsum board work.
 - 5. Acoustical joint sealant and backing at perimeter of gypsum board partitions.
- C. Provide gypsum board finishes, applied over framing and board work of Section 09 21 17 - SHAFT WALL ASSEMBLIES. Work of this Section 09 29 00 includes trim, joint treatment, and joint compound finishing.
- D. Install access panels occurring in gypsum board work furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 40 00 - COLD-FORMED METAL FRAMING: Load bearing framing.
- D. Section 06 10 00 - ROUGH CARPENTRY.
- E. Section 06 16 00 - SHEATHING: Wall sheathing.
- F. Section 07 21 00 - THERMAL INSULATION.

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- G. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Furnishing steel door frames.
 - H. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
 - I. Section 09 21 17 - SHAFT WALL ASSEMBLIES: Pre-engineered fire-resistant assemblies including framing and liner boards. Interior Finishing work performed under this Section 09 29 00.
 - J. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING:
 - 1. Non-load bearing partition, ceiling and soffit framing and furring.
 - 2. Deflection track assemblies at tops of metal stud partitions.
 - K. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceilings.
 - L. Section 09 81 00 – ACOUSTICAL INSULATION: acoustical batt insulation.
 - M. Section 09 72 33 – DRY-ERASE WALL COVERING: Wall coverings to be installed on prepared gypsum wall board.
 - N. Section 09 91 00 - PAINTING: Applied finish coatings.
 - O. Section 10 40 00 - SAFETY SPECIALTIES.
 - P. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
 - Q. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Supply and return air registers.
 - R. Division 26 - ELECTRICAL: Independent hangers for suspended lighting fixtures.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM C 475 - Joint Treatment Materials for Gypsum Wallboard Construction.
 - 2. ASTM C 754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.
 - 3. ASTM C 919 - Use of Sealants in Acoustical Applications.
 - 4. ASTM C 1002 - Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 5. ASTM C 1047 - Accessories for Gypsum Wallboard and Veneer Base.
 - 6. ASTM C 1396 - Gypsum Wallboard.
 - 1. ASTM C 1658 - Glass Mat Gypsum Panels.

2. ASTM D 3678 - Polyvinyl chloride material for indoor exposure.
3. ASTM D 1784 - Polyvinyl chloride material for outdoor exposure.
4. ASTM E 90 - Method of Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
5. ASTM E 119 - Fire Tests of Building Construction and Materials.
6. GA 201 - Gypsum Board for Walls and Ceilings.
7. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish, Glass Mat and Fiber-Reinforced Gypsum Panels.
8. GA 216 - Recommended Specifications for the Application and Finishing of Gypsum Board.
9. GA 220 - Recommended Specifications for Gypsum Board Winter Related Job Problems.
10. UL - Fire Resistance Directory.
11. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
12. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Work of this Section shall be closely coordinated with the work of Section 05 40 00 - COLD-FORMED METAL FRAMING and Section 09 22 16 - NON-STRUCTURAL METAL FRAMING, to assure the steady progress of the Contract.

B. Sequencing: Do not install gypsum board until all pipes, ducts, conduits, and other such items which are to be enclosed thereby, have been permanently installed, inspected and approved.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
2. Shop Drawings:
 - a. Details of any special conditions associated with fireproofing.
 - b. Mark-up a set of blackline interior elevations indicate corrections to grid layout and provide dimensioning showing locations of all proposed control joints and expansion joints.
 - 1) Provide interior elevation drawings for interior elevations which are not included as part of the Contract Drawing set.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum board.
- C. Qualifications - Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
- B. Storage and Handling Requirements:
 - 1. Store materials inside, under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
 - a. Neatly stack board materials flat to prevent sagging.
 - 2. Handle board materials so to prevent damage to edges, ends and surfaces.
 - 3. Protect trim, accessories and corner beads from being bent or damaged.

1.9 SITE CONDITIONS

- A. Environmental Conditions: In accordance with GA 216, maintain minimum ambient temperature of 50 degrees Fahrenheit 48 hours before, during taping and compounding, and until completely dry thereafter.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Gypsum board products:
 - a. United States Gypsum Company, Chicago IL. (USG).
 - b. National Gypsum Company, Charlotte NC. (Gold Bond and ProForm Brands).
 - c. G-P Gypsum Corporation, Atlanta GA.

- d. Continental Building Products, Hendron VA.
 2. Polyvinyl chloride trim and accessories:
 - a. Plastic Components, Inc., Miami FL.
 - b. Trim-Tex Drywall Products, Lincolnwood IL.
 - c. Vinyl Corporation, Miami FL.
 - d. Alabama Metal Industries Corporation, (AMICO) Birmingham, AL.
 3. Aluminum Reveal trim:
 - a. Fry Reglet Corporation, Norcross GA.
 - b. Gordon Inc., Shreveport LA.
 - c. Pittcon Industries, Inc., Riverdale MD.
 - d. Stockton Products, North Las Vegas, NV.
 4. Structural laminate corner and edge trim: Structus Building System Technologies, Bend OR.
 5. Joint sealants:
 - a. Tremco, Beachwood OH.
 - b. United States Gypsum Company, Chicago IL.
 - c. Pecora Corporation, Harleysville PA.
- B. The design and details as shown on the Drawings and the model numbers specified herein are to establish the standards of design and quality and not to limit competition.

2.3 DESCRIPTION

- A. Regulatory Requirements
1. Obtain certificate of compliance from authority having jurisdiction indicating approval of specified products.
 2. Fire resistance ratings: Where gypsum board systems with fire-resistance ratings are indicated, provide materials and assemblies of the rating required, tested per ASTM E 119, which are identical to those indicated by reference to Gypsum Association file numbers in "Fire Resistance Design Manual" or to design designation in the Underwriters Laboratories "Fire Resistance Directory" or in listing of other testing agencies acceptable to authorities having jurisdiction and to the Owners' insurance underwriters.
 3. Seismic Compliance: Nonstructural components that are permanently attached to structures and their support attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance to local jurisdiction.
- B. Sustainability Requirements:
1. Gypsum Board Recycled Content: Use maximum available percentage of recycled materials but not less than that required to meet LEED Credit MR 5.2. Gypsum board products incorporated into the work shall contain not less than 50 percent of recycled materials.

2.4 BOARD MATERIALS

- A. Non-rated and Fire rated gypsum board (for wall fire resistant ratings 120 minutes and less): UL fire resistance rated, ASTM C 1396 'Type X' board, 5/8 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges.
1. Acceptable products include the following, or approved equal:
 - a. USG Sheetrock brand "Firecode Core"
 - b. National Gypsum Company, Gold Bond brand product "Fireshield Gypsum Board".
 - c. G-P Gypsum Corporation product, "ToughRock Fireguard".
 - d. Continental Building Products, product "Firecheck Type X".
- B. Sag-resistant gypsum board ceiling panels: Non-rated 1/2 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges, conforming to ASTM C 1396.
1. Acceptable products include the following or approved equal:
 - a. USG Sheetrock brand product "Interior Ceiling Panel, Sag Resistant".
 - b. National Gypsum Company, Gold Bond brand product "High Strength Ceiling Board".
 - c. G-P Gypsum Corporation product, "ToughRock CD Ceiling Board".
 - d. Continental Building Products, product "Sagcheck".
 2. At fire-resistant rated ceilings, provide 5/8 inch thick fire-rated gypsum board as specified herein.
- C. Abuse-Resistant Gypsum Board (ARGB): UL type FRX fire resistance type, ASTM C-1278 board, complying with ASTM C1658 and ASTM C36.
1. ASTM C1629 Test Result Characteristics, minimum Level ratings:
 - a. Abrasion: Level 2.
 - b. Indention: Level 1.
 - c. Soft Body Impact: Level 2.
 - d. Hard Body Impact: Level 1.
 2. Acceptable products include the following or approved equal:
 - a. USG Sheetrock brand product "Moldtough AR", or "Fiberock AR panels".
 - b. National Gypsum Company, Gold Bond brand product "Hi Abuse XP".
 - c. G-P Gypsum Corporation product, "Dense Armor Plus Abuse".
 - d. Continental Building Products, product "Protecta AR 100 Type X with Mold Defense".
- D. Paperless moisture and mold resistant board: 5/8 inch thick Glass mat, water-resistant, mold-resistant interior wall panel: Coated inorganic glass mat-faced, with Type "X" water-resistant, treated core gypsum wallboard. Physical properties conforming to the applicable sections of ASTM C 1177 and ASTM D 3273.
1. Acceptable products include the following or approved equal:
 - a. USG Sheetrock brand product "Mold-Tough Firecode X".
 - b. National Gypsum Company, Gold Bond brand product "eXP Interior Extreme Gypsum Panel".

- c. G-P Gypsum Corporation product, "DensArmor Plus Paperless Interior Panel.
 - d. Continental Building Products, product "Weather Defense Platinum Interior, Type X".
- E. Flexible gypsum board for curved-partition construction (installed as multi-layer construction, minimum 2 layers): Non-rated, conforming to ASTM C1396, 1/4 inch thick, 48 inch width, of lengths to minimize end joints, with tapered edges. Boards shall be capable of bending to a 5'-0 inch radius and greater.
- 1. Acceptable products include the following, or approved equal:
 - a. USG Sheetrock brand "Sheetrock Gypsum Panels, 1/4" Flexible."
 - b. National Gypsum Company, Gold Bond brand product "High Flex".
 - c. G-P Gypsum Corporation product, "ToughRock Flexroc."
 - d. Continental Building Products: no equivalent product"

2.5 TRIM AND EDGE COMPONENTS

- A. Polyvinyl chloride (PVC) trim accessories, conforming to ASTM D 1784 and C 1047.
- 1. J Bead: Edge trim with exposed 1/2 inch face cap, furnish trim model number corresponding to the board thickness where installed.
 - a. Plastic Components model number: 200X-50 (for 1/2 inch thick board) or 200S-58 (for 5/8 inch thick board).
 - b. Trim-Tex, model: 1110 (for 1/2 inch thick board) or 1210 (for 5/8 inch thick board).
 - c. Vinyl Corporation model number: JB50 (for 1/2 inch thick board) or JB58 (for 5/8 inch thick board).
 - d. AMICO model number: AMJB50 (for 1/2" thick board) or AMJB58 (for 5/8" thick board).
 - 2. L Bead: casing edge trim, furnish trim model number corresponding to the board thickness where installed
 - a. Plastic Components model number: 221-50 (for 1/2 inch thick board) or 221-58 (for 5/8 inch thick board).
 - b. Trim-Tex, model: 1710 (for 1/2 inch thick board) or 1810 (for 5/8 inch thick board).
 - c. Vinyl Corporation model number: SB50 (for 1/2 inch thick board) or SB58 (for 5/8 inch thick board).
 - d. AMICO model number: AMSB50 (for 1/2 inch thick board) or AMSB58 (for 5/8 inch thick board).
 - 3. L-Bead with removable leg: Casing edge trim for joints at ceilings doors and windows, with removable leg strip, furnish trim model number corresponding to the board thickness where installed
 - a. Plastic Components model number: 224-50 (for 1/2 inch thick board) or 224 (for 5/8 inch thick board).
 - b. Trim-Tex model: 9002 (for both 1/2 inch thick board and 5/8 inch thick board).

- c. Vinyl Corporation model number: TMJB50 (for 1/2 inch thick board) or TMJB58 (for 5/8 inch thick board).
 - d. AMICO product "Zip Strip" model number: AMZIP50 (for 1/2 inch thick board) or AMZIP58 (for 5/8 inch thick board).
 4. Corner beads, 90 degree with 1-1/4 inch flanges:
 - a. Plastic Components model number: 209.
 - b. Trim-Tex model: 4010.
 - c. Vinyl Corporation model number: CB125.
 - d. AMICO model number: AMCB125.
 5. Control joints: "V" type joint with nominal 3/16 inch reveal and removable temporary tape:
 - a. National Gypsum model "EZ Strip Expansion Joint".
 - b. Plastic Components model number: 2027-16.
 - c. Trim Tex model: 093V.
 - d. Vinyl Corporation model number: CJV16.
 - e. AMICO model number: AMDCJV16.
- B. Structural laminate corner and edge trim:
 1. Specified manufacturer: To establish a level of strength, quality and visual characteristics desired, Drawings and Specifications are based on Structus Building System Technologies, Bend OR, product: "NoCoat".
 2. Provide tapered high-strength co-polymer core, joint tape, and formulated surface paper composite trim in shapes and sizes required by gypsum board corners, edges, and end conditions encountered.
 - a. NoCoat UltraFlex:
 - 1) NoCoat ZoomaFlex.
 - b. NoCoat UltraTrim:
 - 1) Inside corners.
 - 2) Outside corners.
 - 3) Bull nose trim.
 - 4) "L" shaped trim.
 - c. Accessories:
 - 1) Baseboard transition caps.
 - 2) Multi-directional corner caps.
- C. Edge trim at corners. Schlüter Systems L.P., product series "Schiene-A", 1/8 inch height, or as otherwise required for floor base thickness, fabricated from extruded aluminum with integrated joint spacer.
 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Schlüter Systems L.P., Plattsburgh NY.
 - b. Custom Building Products, Inc., Seal Beach, CA.
 - c. Ceramic Tool Company Inc., Waukesha WI.

- D. Reveal trim: extruded aluminum trim with 1/4 inch wide recess by nominally 1/2 inch deep reveal channel with punched tapered fins.
1. Fry Reglet Corporation, model number: DRM-50-25.
 2. Gordon Inc.: 514-1/2.
 3. Pittcon Industries, Inc., model number: SWR-025-050.
 4. Stockton Products, model number: DRM, X=1/2, Y=1/4

2.6 ACCESSORIES

- A. Tapes and compound:
1. Joint tape (at paper-faced gypsum): Nominal 2 inch wide, high strength, cross-fibered paper drywall tape.
 2. Joint tape (at fiberglass faced gypsum): Nominal 2 inch wide, self adhering (adhesive backed), fiberglass mesh tape.
 3. Joint Compound for setting fiberglass joint tape:
 - a. Cetainteed, Valley Forge PA., product "ProRock Moisture and Mold Resistant 90".
 - b. Georgia Pacific Gypsum LCC., Pittsburgh PA, product "Densarmor Cote"
 - c. CTS Cement Manufacturing Corporation, Cypress CA., product "Rapid Set OnePass".
 4. Joint Compound for setting paper joint tape: 'Speed-setting type compound', field mixed.
 - a. Acceptable products, or approved equal:
 - 1) USG product "Durabond 20".
 - 2) ProForm Brand product "ProForm QuickSet 20".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock All-Purpose Dry Mix"
 5. Joint Compound for finishing: field mixed joint compound or factory pre-mixed compound.
 - a. Field-mixed compounds: acceptable products, or approved equal:
 - 1) USG product "Durabond 90".
 - 2) ProForm Brand product "ProForm QuickSet 90".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock Setting Compound 90".
 - b. Factory pre-mixed compounds: acceptable products, or approved equal:
 - 1) USG product "Ready-Mixed Joint Compound".
 - 2) ProForm Brand product "ProForm All Purpose Compound".
 - 3) Georgia Pacific Gypsum LCC, product "ToughRock Ready Mix All-Purpose Compound"
- B. Fasteners (interior board systems):
1. Type S, bugle head screws complying with ASTM C 1002, for applying gypsum board to metal framing, ceiling grid system, and furring channels.
 - a. Not less than 1 inch long for single layer gypsum board.
 - b. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board.

2. Type S-12, fine thread self-drilling screws complying with ASTM C 1002, for applying gypsum board to light gage metal framing.
 - a. Not less than 1 inch [25 mm] long for 1/2 inch thick single layer gypsum board.
 - b. Not less than 1-1/4 inch [31mm] long for 5/8 inch thick single layer gypsum board.
 - c. Not less than 1-5/8 inch [41mm] long for double-layer gypsum board,
 - C. Laminating adhesive: Ready mix joint compounds as specified herein above.
 - D. Joint Sealers (Acoustical Sealant): One component acrylic latex, permanently elastic, non-staining, non-shrinking, non-migrating and paintable. Acceptable products include the following, or approved equal.
 1. Owens Corning, product: "QuietZone Acoustical Sealant."
 2. Pecora Corporation, Harleysville PA.; product " AC-20 FTR".
 3. Specified Technologies, Inc. (STI), product "Smoke 'N" Sound Acoustical Sealant".
 4. Tremco, Beachwood OH.; product, "Acoustical Sealant".
- 2.7 SOURCE QUALITY CONTROL
- A. Obtain gypsum board and finishing products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that all items which are to be enclosed by Work of this Section, have been permanently installed, inspected and approved.
- B. Inspect framing and other substrates; verify that they are in proper condition to receive the work of this Section.
- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. During the operation of gypsum board work, protect all wood, metal, glass, flooring, and other finished materials against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

3.3 INSTALLATION - GENERAL

- A. General: Perform erection procedures for the various gypsum board system conditions, except as otherwise specified, as set forth in GA 201, GA 216, GA 220, the written instructions of gypsum board manufacturer, together with the additional requirements specified herein and as indicated on the Drawings.

- B. Where fire-resistive rated assemblies are indicated, erect gypsum board systems in strict accordance with the manufacturers' UL listed test constructions for the required fire rating on each specific assembly.
- C. Install specified control joints where indicated on Drawings and where run of partitions, or furred surfaces exceeds 30 feet. Show locations of all control joints on shop drawings.
 - 1. Locate control joints at corners of head frames of doors.
 - 2. Run vertical control joints continuously to top of partition, shaft wall or furred area, as applicable.

3.4 INSTALLATION OF GYPSUM BOARD

- A. Screw fasten only, gypsum board to framing and furring, with ends and edges occurring over firm bearing. At all door jambs screw fasten gypsum panels 8 inches on center to both box studs
 - 1. Erect single layer fire-resistance rated gypsum board vertically.
 - 2. Erect standard and moisture resistant layer board in most economical direction.
 - 3. Erect ceiling and soffit gypsum boards to meet UL requirements, where applicable, stagger end joints over supports. Secure gypsum board with fasteners inserted through ceiling buttons; anchor fasteners directly to framing or suspended support system.
- B. Wherever items penetrate the gypsum board surfaces, use extra care in cutting the gypsum board to ensure a uniformly-dimensioned joint between the penetrating item and the gypsum board, and fill joints with specified sealant material. Verify the expected deflection factor of the penetrating members, and cut the gypsum accordingly, to prevent damage thereto from the deflecting members.
- C. Installing Trim Accessories:
 - 1. General: For trim with back flanges intended for fasteners, attach to framing with same screw fasteners used for gypsum board. Otherwise, attach trim according to manufacturer's written instructions.
 - a. Nailing, stapling, or crimping methods to install trim components is prohibited.
 - 2. Install corner beads at all exterior corners of gypsum boards.
 - 3. Install casings (PVC trim) wherever gypsum board meets a dissimilar material, and in other locations indicated on the Drawings, except at floors where bottom of the board will be concealed by base, integral with flooring, resilient base, wood base or carpeted base.

3.5 INSTALLATION OF REVEAL TRIM

- A. General: Install reveal trim in accordance with trim manufacturer's recommendations and as follows:
 - 1. Lay out drywall surface with chalk lines to exact heights and locations indicated. Cut out gypsum board with router.
 - 2. Cut extrusions to proper lengths and dry-fit to drywall. Miter all corners for hairline joints.

3. Screw install trim through at 8 inches on center maximum with standard bugle head drywall screws.
4. Provide continuous reveals at horizontal at top of base, top of bumper rail, top of magnetic writable surface. Provide vertical reveal at corridors as indicated on Drawings.

3.6 APPLICATION OF ACOUSTICAL SEALANT

- A. General: Install sealant and backing in accordance with the recommendations of ASTM C-919 and sealant manufacturer's recommendations.
 1. Perform preparation in accordance with C-790. Thoroughly clean all joints, removing all loose mortar, oil, grease, dust, frost, and other foreign materials that will prevent proper adhesion of primers and sealant materials.
 2. If so recommended and furnished by the specific sealant manufacturer, apply primer to all joint surfaces, taking care not to stain adjacent surfaces.
- B. Seal all partition perimeters prior to taping or compounding. Where perimeters are edged with metal trim, apply sealant and backing material between trim and dissimilar material.
- C. Seal all penetrations in partition types designated for "acoustical" insulation. Penetrations to receive sealant include electrical boxes, plumbing, heating and air conditioning ducts, telephone, intercom hookups and similar items.
 1. Install joint bead back-up in all joints in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - b. Do not stretch back-up material into joints.
 - c. Install bond breaker wherever recommended by the sealant manufacturer to prevent bond of the sealant to surfaces where such bond might impair the Work.
 2. Apply sealant in continuous beads without open joints, voids or air pockets
 - a. The depth of sealant and caulking materials shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
 3. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.7 APPLICATION OF JOINT TREATMENT

- A. Install joint tape at all joints where gypsum boards abut and where boards form internal corners, whether or not such joints will be concealed from view.
- B. Apply compound to all joints, edges, corners, fastener head depressions and abrasions in the surfaces, whether or not such conditions will be concealed from

view. Sand completely smooth all compound surfaces, which will be exposed to view, and leave ready to receive applied coatings or finish.

- C. Apply compound at base trim, so that joint compound will slightly taper from aluminum edge to 36 inches above finished floor.
- D. Provide the minimum levels of gypsum board finishes as defined by the Gypsum Association recommended specifications GA-214 and GA-216, per the following:
 - 1. At areas hidden from view, except as otherwise specified: Level 1.
 - 2. At areas hidden from view, requiring a fire rating: Level 1.
 - 3. At concealed plenum spaces above ceilings attic spaces: Level 1.
 - 4. At surfaces scheduled to receive applied acoustical wall panels: Level 3.
 - 5. At surfaces scheduled to receive plastic wall panels specified under Section 09 77 63 - SANITARY WALL PANELS: Level 3.
 - 6. At surfaces scheduled to receive painted finishes: Level 4, except at each of the following conditions, provide Level 5 finish:
 - a. Surfaces at Third Floor walls/ceiling at skylights in Atrium.

3.8 TOLERANCES

- A. Maximum variation for gypsum board partitions and ceilings from true flatness: 1/8 inch per 10 feet, noncumulative.

3.9 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris, scraps, and deposits of compound and gypsum fill.
- B. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of gypsum fill, and other materials installed under this Section.
- C. Waste Management:
 - 1. Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

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Section 09 30 00

TILING

(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 03)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.
- C. Trade Contract Requirements: As provided under Section 09 00 03 - TILE TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 03.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Ceramic tile.
 - 2. Porcelain tile.
 - 3. Porcelain tile at face of Servery Counter
 - 4. Quarry Tile
 - 5. Tile base and associated trim.
 - 6. Stone thresholds and saddles.
 - 7. Fluid applied waterproofing membrane at wet floor areas occurring over occupied spaces and where additionally indicated.
 - 8. Anti-fracture membrane at slab on grade conditions and "dry" flooring areas.
 - 9. Cementitious tile backer board.
 - 10. Installation systems, adhesives, mortars and grouts.
 - 11. Control joints in tiled floors.
- B. Install the following furnished under the designated Sections:
 - 1. Install access panels into tiled walls as specified under Section 08 31 00 - ACCESS DOORS AND PANELS.
- C. Perform drilling and cutting in tile surfaces, as required to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate number 1 affects the scope of work of Section 09 30 00.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab substrate.
- E. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit substrate.
- F. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- G. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.
- H. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: access panels, occurring in partitions and walls.
- I. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal stud framing to receive cementitious backer board installed under this Section.
- J. Section 09 00 03 – TILE TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- K. Section 09 30 16 - QUARRY TILING: Quarry tile flooring with setting systems.
- L. Section 10 28 13 - TOILET ACCESSORIES: Furnishing toilet accessories and installation templates.
- M. Division 22 - PLUMBING: Floor drains.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A108.1A - Installation of Ceramic Tile in the Wet Set Method, with Portland Cement Mortar.
 - 2. ANSI A108.1B - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar.
 - 3. ANSI A108.4 - Installation of Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
 - 4. ANSI A108.4 - Installation of Ceramic Tile Installed with Organic Adhesives or Water-Cleanable Tile Setting Epoxy Adhesive.
 - 5. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.

6. ANSI A108.6 - Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy.
 7. ANSI A108.7 - Installation of Electrically Conductive Ceramic Tile with Conductive Dry-Set Portland Cement Mortar.
 8. ANSI A108.8 - Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout.
 9. ANSI A108.9 - Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.
 10. ANSI A108.10 - Installation of Grout in Tilework.
 11. ANSI A108.11 - Interior Installation of Cementitious Backer Units.
 12. ANSI A118.1 - Dry-Set Portland Cement Mortar.
 13. ANSI A118.2 - Conductive Dry-Set Portland Cement Mortar.
 14. ANSI A118.3 - Chemical-Resistant, Water-Cleanable, Tile Setting and Grouting Epoxy and Water-Cleanable Tile Setting Epoxy Adhesive.
 15. ANSI A118.4 - Latex-Portland Cement Mortar.
 16. ANSI A118.5 - Chemical-Resistant, Furan Mortar and Grout.
 17. ANSI A118.6 - Ceramic Tile Grouts.
 18. ANSI A118.7 – Polymer Modified Cement Grouts
 19. ANSI A118.8 - Modified Epoxy Emulsion Mortar/Grout.
 20. ANSI A118.9 - Cementitious Backer Units.
 21. ANSI A118.10 - Waterproofing.
 22. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile.
 23. ANSI A137.1 - Specifications for Ceramic Tile.
 24. ANSI A10.20 - Safety Requirements for Ceramic Tile, Terrazzo and Marble Work.
 25. ASTM C 144 - Aggregate for Masonry Mortar.
 26. ASTM C 150 - Portland Cement.
 27. ASTM A 185 - Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 28. ASTM C 627 - Evaluating Ceramic Floor Tile Installation Systems.
 29. ASTM C 920 - Specifications for Elastomeric Joint Sealant.
 30. ASTM C 1026 - Measuring Resistance of Ceramic Tile to Freeze Thaw Cycles
 31. ASTM C 1027 - Determining Visible Abrasion Resistance of Glazed Ceramic Tile
 32. ASTM D 226 - Asphalt Saturate Felt used in Roofing and Waterproofing.
 33. ASTM D 2103 – Polyethylene Film
 34. ASTM E 119 – Fire Test of Building Construction and Materials.
 35. U.S. Department of Interior, National Park Service, Technical Preservation Services:
 - a. Preservation Tech note 40: Preserving Historic Ceramic Tile Floors.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:

1. TCNA (formerly TCA) - Handbook for Ceramic Tile Installation, latest edition.
- C. Definitions: For the purposes of these specifications the following terms are defined:
1. Wet Areas: Rooms/spaces which has plumbing fixtures, sinks, toilets, or floor drains. Wet areas additionally include rooms/spaces which are exposed to weather.
 2. Dry Areas: Rooms/spaces which have no plumbing, sinks, toilets, or floor drains.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
1. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation meetings:
1. At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Coordinate time of meeting to occur prior to installation of work under the related sections named below.
 - a. Required attendees: Architect, General Contractor, Tile Installer's Project Superintendent, Tile setting materials manufacturer's technical representative and representatives for installers of related work specified under the following Sections:
 - b. Agenda:
 - 1) Scheduling of tiling operations.
 - 2) Review of setting methods and materials required.
 - 3) Review of staging and material storage locations.
 - 4) Coordination of work by other trades.
 - 5) Protection of completed tile work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 - b. Materials list: List of products proposed to be provided under this Section, submitted within **10** calendar days after the Contractor has received Notice to Proceed.
 2. Shop Drawings: 1/4 inch scale elevations and plans of tile patterns.
 3. Selection Samples:
 - a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.

4. Verification Samples:
 - a. Mount tile and apply grout on one 24 by 24 inch cement backerboard board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
 - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
 - c. Stone threshold, 12 inch long samples in shaped profile.
 5. Source Quality Control Submittals:
 - a. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.
 - 1) Comply with ANSI A137.1 for special purpose tiles.
 6. Sustainable Design Submittals
 - a. Provide sustainable design submittals including, but not limited to, Environmental Product Declarations (EPD), Health Product Declarations (HPD), and General Emissions Testing.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation:
 2. Record Documentation:
 3. Sustainable Design Closeout Documentation:
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials in, an amount equal to 3 percent of tile and trim of each color, finish and type installed.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
1. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
 2. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.
- B. Sole Source: Obtain installation products required for the Work of this Section from a single manufacturer.
- C. Qualifications:
1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 MOCK-UPS

- A. Provide mock-up under provisions of Section 01 45 00 - QUALITY CONTROL.

- B. Provide mock-up panels, minimum 25 square feet, illustrating color, texture and finish, and demonstrating the minimum standard for the Work.
 - 1. Mock-up will demonstrate quality of work, construction methods, color and texture of tile, flatness of installation, joint spacing and color of grout. Include typical tile accessories and a control joint.
 - 2. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
 - 3. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
 - 3. Deliver and store tile setting materials in original, sealed, containers showing manufacturer's identification, year of production, new weight, date of packaging, and location of packaging.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 - 2. Store waxed tile in manner keeping wax off the sides and backs of the units.
 - 3. Store and protect containers above floor level, keep dry until ready for use.
 - 4. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21° C) temperature for 24 hours prior to use.

1.10 SITE CONDITIONS

- A. Environmental conditions:
 - 1. General: Maintain ambient temperatures between 50 (10° C) and 80 (26° C) degrees Fahrenheit in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
 - 2. Special environmental conditions for epoxy setting and grout materials: Maintain ambient temperatures between 65 degrees Fahrenheit (18° C) and 80 degrees Fahrenheit (27° C) in tiled areas, for 24 hours prior to installation, during installation and for 7 days after completion.
 - 3. When temperature of substrate exceeds 90 (32° C) degrees Fahrenheit, contact manufacturer for instructions.
- B. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.

- C. Shade work areas in direct sunlight during installation to prevent rapid evaporation caused by excessive heat.

1.11 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty: The manufacturer of installation systems, adhesives, grouts and mortars shall provide a comprehensive non pro-rated written five (5) year warrantee against defective products which covers replacement materials and labor costs for demolition, tile accessories, and installation systems.
 - 1. Warranty to provide for tile lifting or separation from substrate, and setting bed/grout deterioration, when products have been installed with referenced TCNA setting systems using specified setting and grout materials.
 - 2. Warranty excludes structural failure, movement or cracking of substrate materials, and workmanship performed not in accordance with manufacturer's instructions and industry standard guidelines.
- C. Special Warranty: Provide 2 year, non pro-rated warranty which shall include provisions for cracking, breakage or failure of tile due to defective workmanship
 - 1. Materials must be compatible and from one source, single source responsibility for waterproofing, installation, mortars and grouts. Job-site mixtures of sand portland cement and site dilution of additives shall not be permitted.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
 - 1. Porcelain tile:
 - a. American Olean Tile Company, Lansdale PA.
 - b. Crossville Ceramics, Crossville TN.
 - c. Dal-Tile Corporation, Dallas TX.
 - 2. Glazed ceramic wall tile:
 - a. American Olean Tile Company, Lansdale PA.
 - b. Dal-Tile Corporation, Dallas TX.
 - c. United States Ceramic Tile Company, Sparta OH.
 - 3. Mortars, adhesives & Grouts:
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Laticrete International, Inc., Bethany CT
 - c. Mapei Corporation, Elk Grove IL.
 - 4. Cementitious tile backer board ("Cement board"):
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Fin Pan, Inc., Hamilton OH.

- c. Unifix, Inc., division of National Gypsum Company, Charlotte, NC.
 - d. United States Gypsum Company, Chicago, IL.
5. Edging materials:
- a. Schlüter Systems L.P., Plattsburgh NY.
 - b. Custom Building Products, Inc., Seal Beach, CA.
 - c. Ceramic Tool Company Inc., Waukesha WI.

2.2 PORCELAIN TILE

- A. Porcelain tile: 1/4 inch thick, uniform appearance with a minimum 4 percent pre-consumer recycled content, meeting ANSI A137.1 with a breaking strength of greater than 125 lbf and water absorption between 10-20 percent.
1. Tile Type designated "PT": Dal-Tile, "Ever". Color: "Moon".
 - a. Includes porcelain tile at face of Servery Counter (Base Bid, and not included as part of Alternate Number 1).
 2. Sizes: 12 inch by 24 inch and 24 inch by 24 inch in patterns indicated on Drawings.
 3. Up to 8 colors (1 field, 7 accent) will be required for field and accent tiles in patterns indicated or provided by the Architect

2.3 CERAMIC MOSIAC TILE

- A. Ceramic mosaic tile: Standard Grade unglazed ceramic mosaic tile, conforming to ANSI A137.1, nominal 1 inch diameter by 1/4 inch thick, porcelain body, cushion-edges. Floor tiles shall be non-slip, containing not less than 7-1/2% by weight of silicone carbide or other rustproof abrasive of equal hardness.
1. Dal Tile: "Penny Rounds Mosaic".
 2. Color: "Morrell", number 165-ZI-250-002

2.4 SETTING MATERIALS

- A. Thin-set polymer-modified Portland cement dry-set mortar, complying with the bond strength requirements of ANSI A118.4.
1. Acceptable products are limited to:
 - a. Mapei product: "Kerabond" with "Keralastic" additive.
 - b. Laticrete product number 254 Platinum, with antimicrobial additive.
 - c. Custom Building Products " Porcelain Tile Mortar"
- B. Mortar for porcelain tile: complying the requirements of ANSI A118.4. Acceptable products are limited to:
1. Mapei product: "Grani-Rapid".
 2. Laticrete product number 254 Platinum.
 3. Custom Building Products " Porcelain Tile Mortar"
- C. Fluid applied waterproofing membrane: ASTM C627 classification "Extra Heavy". Two component liquid rubber membrane cold applied, load bearing, bonded, non-toxic, non-flammable, and non-hazardous, used with 20 mil (0.5mm) thick flexible nonwoven rot-proof fiberglass reinforcing fabric.

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1. Waterproofing membrane shall be IAPMO certified as shower pan liner under the International Plumbing Code.
 2. Waterproofing membrane shall provide crack suppression and isolation for anti-fracture per ANSI A118.12.5.4, spanning 1/8 inch (3mm) crack, and meet the following physical requirements:
 - a. Water Permeability (at 30ft.hydro/0.9 atmos/91.2kPa): Nil.
 - b. Elongation at break (ASTM D-751): 20 to 30%
 - c. Service Temperatures: -20° to +280°F. (-29°to +138°C).
 - d. Tensile breaking strength: 2950psi (20.4MPa;207kg/cm²)
 - e. Bond strength to concrete: 350psi (2.4MPa;24kg/cm²)
 - f. Resistance to chemicals (90 day immersion):
 - 1) Brine solution Not Affected.
 - 2) Sugar solution Not Affected.
 - 3) Milk Not Affected.
 - 4) 10% Citric Acid Not Affected.
 - 5) 3.5 percent HCl Acid: Not affected.
 - 6) 5% Acetic Acid: Not Affected
 - 7) 1% Alkali solution: Not Affected
 - 8) Urine: Not Affected
 - 9) Calcium chloride: Not Affected.
 - 10) Toluol Softens.
 - g. Floor Tile Installation Evaluation (ASTM C627-81) 900 cycles
 - h. Service Rating (TCNA) Extra Heavy Duty
 3. Acceptable products are limited to:
 - a. Mapei product: "Mapelastic 315" with fabric reinforcing.
 - b. Laticrete product "Laticrete 9235 Waterproofing" with fabric reinforcing.
 - c. Custom Building Products "9240 Waterproofing".
- D. Anti-fracture membrane for crack suppression and substrate crack isolation. Two component system (liquid and fabric) complying with TCNA performance level: Extra Heavy Service".
1. Acceptable products are limited to:
 - a. Mapei product: "Plani/Lastic".
 - b. Laticrete product "Blue 92".
 - c. Custom Building Products "Crack Buster Pro" or "Fracture Free".
- E. Cementitious tile backer board ("cement board"): 1/2-inch nominal thickness, glass fiber reinforced, with a minimum compressive strength of 1,250 pounds per square inch and minimum flexural strength of 750 pounds per square inch.
1. Acceptable products include the following:
 - a. Custom Building Products, Inc. product "WonderBoard Lite" (7/16 inch thickness)
 - b. Fin Pan, Inc., product: "Util-a-Crete".
 - c. National Gypsum Company, Charlotte, NC. product "PermaBase".

2.5 GROUTING MATERIALS

- A. Grout for walls having joints less than 1/8 inch width: Acrylic modified Portland cement (unsanded) grout conforming to ANSI 118.6. Acceptable products are limited to:
 - 1. Mapei product: "Ker-800" with acrylic latex additive "Plastijoints",
 - 2. Laticrete product "Laticrete 1600 Series (unsanded) with admix 1776 antimicrobial.
 - 3. Custom Building Products PolyBlend unsanded grouts.

- B. Grout for floors, and walls having joints 1/8 inch and greater width: Acrylic modified Portland cement sanded grout conforming to ANSI 118.6. Acceptable products are limited to:
 - 1. Mapei product: "Ultracolor" with acrylic latex additive "Plastijoints",
 - 2. Laticrete product "Laticrete 1500 Series (sanded) with admix 1776 antimicrobial.
 - 3. Custom Building Products PolyBlend sanded grouts.

- C. Epoxy grout: Multi-component epoxy grout, stain resistant, conforming to ANSI 118.3.
 - 1. Epoxy Grout shall be non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured and shall meet the following minimum physical requirements in compliance with ANSI A118.3 test methods:
 - a. Compressive Strength: greater than 3500 psi (24,131 kPa).
 - b. Quarry Tile Shear Bond Strength: 1000 psi (24,131 kPa) min.
 - 2. The finished Epoxy grout shall be chemically and stain resistant to catsup, mustard, tea, coffee, milk, soda, beer, wine, bleach (5% solution), ammonia, juices, vegetable oil, brine, sugar, cosmetics, and blood. It shall also be chemically resistant to dilute acids and alkalis, gasoline, turpentine, and mineral spirits.
 - 3. Acceptable products are limited to:
 - a. Mapei product: "Kerapoxy" grout.
 - b. Laticrete product "SpectraLock Pro Premium". Series.
 - c. Custom Building Products, product "100% Solids Epoxy Gout".

2.6 ACCESSORIES

- A. Edge strips: Design as required for the condition of use, and fabricate from extruded aluminum, mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.

- B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect surrounding in situ materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

- B. Remove existing deteriorated and damaged tile. Remove non-matching previously patched tile.

1. Carefully remove existing deteriorated and damaged tile without harming surrounding tiles. Prior to removing tiles, remove all existing grout surrounding tiles to be removed with a grout saw. For existing grout joints which are wider than 3/8 inch width contractor may utilize a dry-cutting diamond blade, mounted in an angle grinder or circular saw.

- C. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.

- D. Vacuum clean substrate surfaces.

- E. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.

1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.

- F. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 1992 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced ANSI A108 standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.

- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.

1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
2. Clean porcelain tiles (backs) and remove manufacturer's residue.

3. Back-butter tiles as required to provide coverage indicated, except for tiles exceeding 144 square inches which require a complete back application of mortar (100% coverage).
- C. Tile Patterns and types: Tile patterns are shown on the Drawings, if more information is required, obtain the necessary information from the Architect. Do not interrupt tile pattern around openings.
 - D. Tile Layout and installation
 1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
 2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
 3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.
 4. Do not align joints of base units and lowest course of tile, offset joints by one-half of unit width.
- 3.4 INSTALLATION OF CEMENT BOARD
- A. Walls:
 1. Wall framing substrate: Do not install cement board directly over protrusions from stud plane such as heavy brackets or fastener heads.
 2. Make necessary cut-outs. Install cement board horizontally leaving 1/8 to 3/16 space at all joints, including joints with dissimilar materials. Stagger board joints with those of adjacent rows.
 3. Fasten cement board with 1-1/4 inch length type S bugle head screw. Fasten boards every 8 inches on center in field and along edges. At edge conditions, locate fasteners between 1/2 inch to 2 inches from board edge.
 4. At all joints and corners, fill gap solidly with dry-set or latex-modified, portland cement mortar and imbed 2 inch mesh fiberglass table and smooth material over joint and corner.

3.5 INSTALLATION – METAL EDGE TRIM

- A. General: Apply materials in strict accordance with the written instructions and recommendations of edge material and setting materials manufacturers.
 1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
 2. Locations: Provide metal edge at every flooring transition between tile and other flooring materials.
- B. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.
- C. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch [1 mm] to 1/16 inch [1.5 mm], but tile may not

be installed lower than height of trim. Maintain a 1/8 inch [3 mm] minimum uniform joint width between edge of tile and metal trim to be filled by grout.

3.6 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
 - 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 - 2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
 - 3. Exterior tilework: 12 to 16 feet in each direction.
 - 4. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 - 5. At perimeter walls in rooms and spaces larger than 12 feet on one side.
 - 6. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
 - 2. Extend control joints full thickness of tile, setting bed and reinforcing.
- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07900 - JOINT SEALERS.

3.7 FLOORING INSTALLATION – TCNA NUMBER F115 MODIFIED, AT KITCHEN

- A. Description: Medium setting bed tile installation with epoxy grout.
- B. General: Install in accordance with ANSI A108.5, TCNA installation method number F115, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: Medium bed latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: epoxy grout (ANSI A118.3).
- C. Install latex/portland cement mortar bed to a nominal uniform thickness of 3/8 to 3/4 inch (6mm to 18mm).
- D. Install tile ensuring mortar coverage of at least 100 percent on back of tile.
- E. Grouting:

1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.8 FLOORING INSTALLATION – TCNA NUMBERS F122 / F122A (MODIFIED)

- A. Description: Medium bed-set tile installation with reinforced waterproofing membrane, at “wet areas.”
- B. General: Install in accordance with ANSI A108.5, and TCNA installation method number F122A, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 1. Setting materials:
 - a. Membrane: Reinforced waterproofing membrane.
 - b. Bonding coat: Latex modified portland cement (ANSI A118.4).
 2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).
- C. Install liquid applied waterproofing membrane with reinforcing over entire tile substrate area in strict compliance with manufacturer’s written instructions. (TCNA F125-Full).
- D. Install latex/portland cement mortar bed over cured waterproofing membrane to a nominal thickness of 3/32 inch.
- E. Grouting:
 1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.9 FLOORING INSTALLATION – TCNA NUMBER F125 MODIFIED

- A. Description: Medium bed-set tile installation with anti-fracture membrane at “dry” areas and slab-on-grade.
- B. General: Install in accordance with ANSI A108.5, and similar to TCNA installation method number F125 as modified by requirements herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 1. Setting materials:
 - a. Membrane: Anti-fracture membrane.
 - b. Bonding coat: Latex modified portland cement (ANSI A118.4).
 2. Grout materials: Acrylic modified Portland cement sanded grout (ANSI A118.6).
- C. Install anti-fracture membrane over existing cracks and joints in substrate materials.

- D. Install latex/portland cement mortar bed over cured anti-fracture membrane to a nominal thickness of 3/32 inch.
- E. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 48 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.10 WALL TILE INSTALLATION - TCNA NUMBER W244C

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number W244C, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: Latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: Acrylic modified Portland cement (unsanded) grout (ANSI A118.6).
- B. Install latex modified Portland cement mortar bed to a thickness recommended by manufacturer.
- C. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.11 INSTALLATION – METAL EDGE AND TRANSITION STRIPS

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number F113, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
- B. Grouting: Install in accordance with installation requirements of abutting tile.

3.12 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.

- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

End of Section

Section 09 30 16
QUARRY TILING
(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 03)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.
- C. Trade Contract Requirements: As provided under Section 09 00 03 - TILE TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 03.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Quarry tile flooring.
 - 2. Quarry tile base and associated trim.
 - 3. Anti-fracture membrane at slab-on-grade quarry tile flooring areas.
 - 4. Installation systems, adhesives, mortars and grouts.
 - 5. Aluminum transition strip at resilient flooring systems.
 - 6. Control joints in tiled floors.
- B. Perform drilling and cutting in tile surfaces, to accommodate penetrating items of other trades, from templates and instructions furnished by the respective trades.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 07 92 00 - JOINT SEALANTS: Backer rod and sealant at control joints.
- D. Section 09 00 03 – TILE TRADE CONTRACT REQUIREMENTS: Trade Contract requirements for work of this Section.
- E. Section 09 30 00 - TILING: Related tile work.

- F. Section 11 40 00 - FOODSERVICE EQUIPMENT: Walk-in refrigerator and cooler to receive quarry tile provided under this Section.
- G. Division 22 - PLUMBING: Floor drains and floor clean-out covers.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A108.5 - Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
 - 2. ANSI A118.4 - Latex-Portland Cement Mortar.
 - 3. ANSI A118.6 - Ceramic Tile Grouts.
 - 4. TCA Handbook for Ceramic Tile Installation, latest edition.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Include maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 - 2. Selection samples:
 - a. Manufacturer's sample boards for each type and color group of tile specified, and grout colors, for selections by the Architect.
 - 3. Verification samples:
 - a. Mount tile and apply grout on one 32 by 32 inch, or 36 by 36 inch cement backer board, for each tile type and selected color, to indicate color and texture variations, tile flatness and joint size variations.
 - b. Trim shapes and base, in selected colors in types and shapes indicated for project conditions.
 - 4. Grade Certificates: Manufacturer's Master Grade Certificates submitted prior to shipment of tile to project.

1.6 QUALITY ASSURANCE

- A. Conform to ANSI/TCNA A 137.1 and TCNA Handbook for Ceramic Tile Installation.
- B. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.
- C. Tiles delivered to the job or installed in the work which do not fall within the accepted color and texture range demonstrated by the samples shall be removed from the site and replace with acceptable materials.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver tile in manufacturer's sealed cartons, grade-sealed by the manufacturer in accordance with ANSI A 137.1, with grade-sealed unbroken, and clearly marked as to contents, color, and quantity.
- B. Store waxed tile in manner keeping wax off the sides and backs of the units.
- C. Store and protect containers above floor level, keep dry until ready for use.
- D. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions. Store epoxy mortar and epoxy grouts at 70 degrees Fahrenheit (21 degrees C) temperature for 24 hours prior to use.

1.8 ENVIRONMENTAL CONDITIONS

- A. Do not install setting or grouting materials in a closed, unventilated environment. Ventilate propane or fossil fuel heaters to prevent damage to tile work from carbon-dioxide build up.
- B. Maintain ambient temperatures between 50 (10 degrees C) and 80 (26 degrees C) degrees Fahrenheit in tiled areas, during installation of mortar materials and for 7 days after completion.
 - 1. When temperature of substrate exceeds 90 (32 degrees C) degrees Fahrenheit, contact manufacturer for instructions.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.10 WARRANTY

- A. Provide 2 year, non pro-rated warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall provide for cracking, breakage or failure of tile due to defective workmanship.

1.11 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, deliver to the Owner extra materials for future repairs and maintenance.
 - 1. Furnish 2 percent of each size, color, and surface finish of tile specified, but not less than 5 square feet of each type.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work are limited to the following include the following, or approved equal:
1. Quarry floor tile:
 - a. Dal-Tile Corporation, Dallas TX.
 - b. American Olean Tile Company, Lansdale PA.
 - c. Metropolitan Ceramics, Canton, OH
 - d. Summitville Tiles Inc., Summitville OH.
 2. Mortars, adhesives & Grouts:
 - a. Custom Building Products, Inc., Seal Beach, CA.
 - b. Laticrete International, Inc., Bethany CT.
 - c. Mapei Corporation, Elk Grove IL.
 3. Edging materials and transition strips.
 - a. Schüter Systems L.P., Plattsburgh NY.
 - b. Ceramic Tool Company Inc., Waukesha WI.
 - c. Or approved equal.

2.2 TILE

- A. Quarry tile: Dal-Tile "Quarry Textures" or approved equal, nominal 6 by 6 inch by 1/2 inch thick, cushion-edges, in colors as selected by the Architect from Manufacturer's full available range.
1. Base Trim: 5 inch height by 1/2 inch thick, cove base trim, including inside and outside corners, matching field tile, and other shapes indicated or required to produce a completely finished installation.
 2. Provide quarry tile in configurations as indicated on the Drawings. In addition to the selected field color quarry tile flooring shall require a minimum of 1 separate color for accent patterns.

2.3 SETTING MATERIALS

- A. Medium-bed latex modified portland cement mortar: Dry-set mortar for modular tile complying with the bond strength requirements of ANSI A118.4, compatible with color of tile. Acceptable products include the following, or approved equal:
1. Mapei product: "Ultraflex LFT" additive.
 2. Laticrete product number 220 with number 3701 additive.
 3. Custom Building Products: product: " Complete Contact Fortified Mortar"
- B. Self-leveling underlayment, factory pre-mixed with primer: Provide primer at difficult (for adhesion) substrate conditions when recommended by manufacturer: Acceptable products include the following, or approved equal:
1. Mapei product: "Ultra/Plan" or "UltraPlan MB" with "Primer UP" primer where recommended.

2. Laticrete product number 86 - "Laticrete SLU", with "Laticrete SLU Primer" where recommended.
3. Custom Building Products: product: "LevelQuick ES, with Custom "Levelquick Latex Primer", where recommended.

2.4 GROUTING MATERIALS

- A. Epoxy grout: Multi-component epoxy grout, stain resistant, conforming to ANSI 118.3.
 1. Epoxy grout shall be non-toxic, non-flammable, non-hazardous during storage, mixing, application and when cured and shall meet the following minimum physical requirements in compliance with ANSI A118.3 test methods:
 - a. Compressive Strength: 6600 psi (464 kg/cm²) min.
 - b. Shear Bond Strength: 100 psi (70kg/cm²) min.
 - c. Water Absorption: 1/2% max.
 - d. Service Temperature: up to 230°F (110°C)
 2. The finished epoxy grout shall be chemically and stain resistant to catsup, mustard, tea, coffee, milk, soda, beer, wine, bleach (5% solution), ammonia, juices, vegetable oil, brine, sugar, cosmetics, and blood. It shall also be chemically resistant to dilute acids and alkalis, gasoline, turpentine, and mineral spirits.
 3. Acceptable products include the following, or approved equal:
 - a. Atlas Chemicals product: "Rezklad HP Grout".
 - b. Mapei product: "Kerapoxy IEG" series".
 - c. Laticrete product "Latapoxy, 2000 Industrial Grout."
 - d. Custom Building Products" CEG 100% Solids Commercial Epoxy Grout".

2.5 ACCESSORIES

- A. Cleavage membrane: ASTM D 226 Number 15 asphalt saturated felt or ASTM D 2103, polyethylene film, 4 mil thick.
- B. Sealer for quarry tile: Water based acrylic floor sealer,
 1. Aquamix, Seal Beach, CA, Product: Sealer's Choice Gold "Ultra-Solv".
 2. 3M products, Maplewood, MN, Product: "Cornerstone Sealer/Finish."
 3. Summitville Tiles, Inc. Product: SL-80 "Water Based Acrylic Floor Seal".
- C. Transition strips: Design based on Schluter "Reno-Ramp, 3-3/8 inches unless indicated otherwise for the condition of use, and fabricate from extruded aluminum, mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Verify that all concrete substrates are at least 28 calendar days old, completely cured and free of negative hydrostatic conditions or moisture problems.

- B. Beginning of installation means acceptance of substrate and site conditions.

3.2 PREPARATION

- A. Ensure that all anchors, plugs, electrical and mechanical work to be in or underneath tile have been installed.
- B. Vacuum clean substrate surfaces.
- C. Seal concrete substrate cracks with filler; level concrete substrate to acceptable flatness tolerances.
 1. The use of PVA bonding agents or gypsum based leveling materials is prohibited.
- D. Apply conditioner or primer to surfaces as recommended by adhesive manufacturer.

3.3 INSTALLATION - GENERAL REQUIREMENTS

- A. Installation Standards: The American National Standard Specifications for the Installation of Ceramic Tile, 1992 edition (ANSI A108), is hereby made a part of this specification. All work of this Section shall be installed in accordance with the requirements contained in referenced ANSI A108 standards, and as additionally specified below, and in accordance with the manufacturer's specifications of those products used.
- B. Installation Methods: Schedule of substrate conditions, generic type of tile used, with appropriate setting and grouting methods are listed at end of this Section.
 1. Use trowel shapes and sizes as recommended by setting materials manufacturer.
 2. Back-butter tiles to provide coverage indicated.
- C. Patterns and colors: Tile patterns are shown on the Drawings. The Trade Contractor shall note the required final tile layouts including fields, striping, number of colors, and required cutting necessary to produce the representative pattern(s).
- D. Tile Layout and installation
 1. Layout tile on room axis, leaving equal sized border units of not less than one-half tile width.
 2. Cut and fit tile tight to penetrations through tile. Form corners and bases neatly. Align base and wall joints.
 3. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, full without voids, cracks, excess mortar, or excess grout.

3.4 INSTALLATION – METAL EDGE TRIM

- A. General: Apply materials in strict accordance with the written instructions and recommendations of edge material and setting materials manufacturers.
 - 1. Ensure that top surface of metal edge and transition strips align with surface plane of tile.
 - 2. Locations: Provide metal edge at every flooring transition between tile and other flooring materials.
- B. Press perforated anchoring leg of trim into troweled dry set mortar bedding. Trowel additional mortar over perforated anchoring leg of trim to ensure full coverage and support of tile edges.
- C. Solidly embed tiles in manner that tiled surface is flush with top of trim profile. Tile may exceed trim height by 1/32 inch to 1/16 inch, but tile may not be installed lower than height of trim. Maintain a 1/8 inch minimum uniform joint width between edge of tile and metal trim to be filled by grout.

3.5 INSTALLATION OF CONTROL JOINTS

- A. General: Provide control joints where indicated on the Drawings, and as directed by the Architect. Where not indicated, provide joints per the following requirements in specific locations approved by Architect:
 - 1. Interior tilework: 24 to 36 feet in each direction, except where exposed to direct sunlight or moisture.
 - 2. Interior tilework exposed to direct sunlight or moisture: 12 to 16 feet in each direction.
 - 3. Where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, and where changes occur in substrate materials.
 - 4. At perimeter walls in rooms and spaces larger than 12 feet on one side.
 - 5. As continuation of expansion joints, control joints, and seismic joints in the building structure which occur in tile areas.
- B. Locations: Verify exact locations of joints with Architect prior to commencing tile installation.
- C. Control joints:
 - 1. Form control joints neat, straight, and uniformly wide equal to width of normal tile joint. Cut tile neatly and to accurate radius at exposed junction with pipes.
 - 2. Extend control joints full thickness of tile, setting bed and reinforcing.
- D. Keep open joints free of grout and debris until filled with sealant. Install non-contaminating temporary joint filler to maintain joints in clean condition until installation of joint backing and sealant under Section 07 92 00 - JOINT SEALERS.

3.6 FLOORING INSTALLATION – TCNA NUMBER F115 WITH “MEDIUM” SETTING BED

- A. Description: Medium setting bed tile installation with epoxy grout.

- B. General: Install in accordance with ANSI A108.5, TCNA installation method number F115, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: Medium bed latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: Epoxy grout (ANSI A118.3).
- C. Install latex/portland cement mortar bed to a nominal uniform thickness of 3/8 to 3/4 inch (6mm to 18mm).
- D. Install tile ensuring mortar coverage of at least 100 percent on back of tile.
- E. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.7 BASE TILE INSTALLATION - THIN-SET

- A. General: Install in accordance with ANSI A108.5, TCNA installation method number W244C, and as additionally specified herein below. Apply materials in strict accordance with the written instructions and recommendations of setting materials manufacturer.
 - 1. Setting materials: Latex modified Portland cement (ANSI A118.4).
 - 2. Grout materials: epoxy grout (ANSI A118.3).
- B. Install latex modified Portland cement mortar bed to a thickness recommended by manufacturer.
- C. Grouting:
 - 1. Allow tile to fully set prior to grouting; do not grout in less than 24 hours after installation of tile.
 - 2. Grout tile joints in accordance with ANSI A108.10 and as additionally specified.

3.8 INSTALLATION - GROUT

- A. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
- B. Force the maximum amount of the approved grout into joints in accordance with pertinent recommendations contained in ANSI A108.10 and for epoxy grouts, ANSI A108.6.
- C. Fill in joints of cushion-edge tile to depth of the cushion; fill joints of square-edge tile flush with the surface.
- D. Fill all gaps and skips. Do not permit mortar or mounting mesh to show through grouted joints.
- E. Provide hard finished grout which is uniform in color, smooth and without voids, pin holes, or low spots.

- F. Remove all excess grout immediately after installation thereof, wash and rinse tile free from grout film, and tool grout to a uniform density throughout.

3.9 REPAIR

- A. Replace cracked chipped, broken, and otherwise defective tiles.
- B. Remove work not complying with requirements of the Contract Documents or the referenced standards, and promptly replace with work which does comply.

3.10 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from deposits of mortar, grout, and other materials installed under this Section, and wash completed tilework.
 - 1. Do not use acid or acid cleaners to clean tile.
 - 2. When tile is thoroughly clean and dry, polish glazed tile with clean dry cloths.

3.11 CURING

- A. Cover with clean non-staining 40 pound kraft paper. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.12 PROTECTION

- A. Do not permit traffic over finished floor surface until grout and tile materials are fully set, and not less than 72 hours. Protect floor surfaces with heavy red-rosin paper or kraft paper.

End of Section

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Section 09 51 00
ACOUSTICAL CEILINGS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section is work of a Publicly Bid Trade Contractor and includes the following requirements.
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None.
- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A102, A103, A401, A402, A403, A404, A405, A406, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A427, A429, A400, A440, A441, A442, A606, A600, A141A, A141B, A141C, A141D, A142A, A142B, A142C, A143A, A143B, A143C, A605, A426, A428, A430, A431, A432, A433, A434, A435, A471, A472, A473, A601, A604, A609, A620, A625, A607, A461, A602, A690, A451, A603, A300, A301, A311, A312, A313, A314, A315, A316, A317, A318, A319, A320, A321, A322, A520, A521, A522, A523, A524, A541, FP001, FP104, P001, A181, A181A, A181B, A181C, A181D, A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A691, FP101A, FP101C, FP101D, FP102A, FP102B, FP102C,

FP102D, FP103A, FP103B, FP103C, P101A, P101B, P101C, P101D, P102A, P102B, P102C, P102D, P103A, P103B, P103C, P103D, M101A, M101B, M101C, M101D, M102A, M102B, M102C, M102D, M103A, M103B, M103C, M103D, M201A, M201B, M201C, M201D, M202A, M202B, M202C, M202D, M203A, M203B, M203C, M203D, E001, E101A, E101B, E101C, E101D, E102A, E102B, E102C, E102D, E103A, E103B, E103C, E103D, E201A, E201B, E201C, E201D, E202A, E202B, E202C, E202D, E203A, E203B, E203C, E203D, E401A, E401B, E401C, E401D, E402A, E402B, E402C, E402D, E403A, E403B, E403C, E403D, E501A, E501B, E501C, E501D, E502A, E502B, E502C, E502D, E503A, E503B, E503C, E503D, T001, T101A, T101B, T101C, T101D, T102A, T102B, T102C, T102D, T103A, T103B, T103C, T103D, E002.

2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

G. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.

1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE

CONTRACTOR: _____

TRADE CONTRACT FOR TRADE: ACOUSTICAL TILE .

2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Owner will not be responsible for errors, omissions and/or charges for extra work arising from Trade Contractor's failure to familiarize themselves with the Contract Documents and existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- B. Pre-Bid Conference: Bidders are strongly encouraged to attend the Pre-Bid conference; refer to INVITATION TO BID for time and date.

1.4 SUMMARY

- A. The work of this Section consists of acoustical tile where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install the following:
 - 1. Suspended acoustical tile ceiling including suspension system and associated edge moldings.
 - 2. Furnish and install joint sealant at ceiling edge angles where abutting walls.

1.5 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- D. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- E. Section 09 22 16 – NON-STRUCTURAL METAL FRAMING: Metal ceiling and soffit framing for gypsum board, including hanger attachments, wire hangers, and screwable metal tee grid system.
- F. Section 09 29 00 - GYPSUM BOARD: Suspended drywall construction ceilings and soffits.
- G. Division 21 - FIRE SUPPRESSION: Sprinkler heads in ceiling system.
- H. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Air diffusion devices in ceiling.
- I. Division 26 - ELECTRICAL:
 - 1. Fire alarm and smoke detection equipment mounted in ceiling system.
 - 2. Light fixtures and independent hangers for suspended fixtures.

1.6 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM A 641 - Zinc-Coated (Galvanized) Carbon Steel Wire
 - 2. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method "UL Classified".

3. ASTM C 523 - Light reflectance of Acoustical Material by the Integrating Sphere Reflectometer.
4. ASTM C 635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
5. ASTM C 636 - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
6. ASTM E 84 - Surface Burning Characteristics of Building Material "UL Classified"
7. ASTM E 119 - Fire Tests of Building Construction and Materials "UL Classified".
8. ASTM E 413 - Classification for Rating Sound Insulation.
9. ASTM E 580 - Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint.
10. ASTM E 1264 - Classification of Acoustical Ceiling Products.
11. ASTM E 1414 - Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum. "UL Classified".
12. UL Fire Resistance Directory and Building Material Directory.
13. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

B. General References The following reference materials are hereby made a part of this Section by reference thereto:

1. CISCA (Ceilings and Interior Systems Contractors Association) - Acoustical Ceilings: Use and Practice.

1.7 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
2. Be responsible for establishing locations and levels for all work of this Section, except such parts as may be delivered to others and set by them. In such cases assist them in properly locating said parts.

B. Scheduling:

1. Install acoustical units after interior wet work is dry.
2. Schedule work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and overhead work is completed, tested and approved.

C. Sequencing:

1. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
2. Field Measurements:

- a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
3. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, to allow work which will be concealed by the ceilings to be completed prior to commencing installing the ceilings in such locations.
4. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
5. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

1.8 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Shop Drawings:
 - a. Plans of each room in scale to match Contract Drawings; indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to the system.
 - b. All drawings bearing dimensions of actual measurements taken at the project.
 - c. Large scale installation details of special conditions.
 - d. Ceiling Coordination Drawings: Provide reflected ceiling plans at ¼ inch equals 1'-0" scale. Indicate the following (obtain input from installers of the items involved)
 - 1) Substrates to which suspension systems will be attached.
 - 2) Ceiling suspension-members.
 - 3) Structural members to which suspension systems will be attached.
 - 4) Method of attaching hangers to building structure.
 - 5) Carrying channels and supplemental support for ceiling attachment.
 - 6) Items penetrating finished ceiling and ceiling mounted items, including the following:
 - a) Lighting fixtures.
 - b) Diffusers.
 - c) Grilles.
 - d) Speakers.
 - e) Fire suppression devices.
 - f) Fire alarm devices.

- g) And similar items.
 - 3. Verification Samples:
 - a. 4 by 4 inch samples of acoustical units, illustrating material and finish.
 - b. 12 inch long samples of suspension system components including main runners, cross runner and edge trim.
 - B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 - 1. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and guarantees as specified elsewhere herein this Section.
 - C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage. Deliver to the Owner extra ceiling tiles and suspension framing for future repairs and maintenance, from the same manufacturer as those installed, in the following amounts.
 - 1. Acoustical ceiling tiles: 3 percent of each type and color, installed.
 - 2. Suspension framing: 50 linear feet of each type and color utilized on the project.
- 1.9 QUALITY ASSURANCE
 - A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of acoustical ceiling panels.
- 1.10 DELIVERY, STORAGE AND HANDLING
 - A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Do not deliver acoustical ceiling panels to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 - 3. Deliver acoustical ceiling panels in original, unopened packages and store protected in a fully enclosed space.
 - B. Storage and Handling Requirements:
 - 1. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - C. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.

1.11 SITE CONDITIONS

- A. General Contractor shall maintain uniform temperature of minimum of 60 degrees Fahrenheit and humidity of 20 to 40 percent prior to, during, and after installation.

1.12 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty:
1. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Acoustical ceiling panel:
 - a. Armstrong World Industries, Inc., Lancaster, PA.
 - b. USG Interiors Inc., Chicago, IL.
 - c. Certainteed Corporation, Valley Forge, PA.
 - d. National Gypsum Company, Charlotte NC.
 - e. Rockfon North America, Chicago, IL.
 2. Suspension system:
 - a. Armstrong World Industries, Inc., Lancaster, PA
 - b. USG Interiors Inc., (Donn®) Chicago, IL.
 - c. Hunter Douglas Architectural Products Inc., Norcross, GA.
 - d. Rockfon North America, Chicago, IL.

2.2 DESCRIPTION

- A. General Description: Manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectance as indicated.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. Fire Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide materials and construction which are identical to assemblies whose fire-resistance ratings have been tested in

compliance with ASTM E 119 by independent agencies acceptable to the Architect and authorities having jurisdiction.

- B. Surface Burning Characteristics: Provide UL Classified material whose surface burning characteristics, when tested in compliance with ASTM E 84 are Class A.
- C. Where the following ratings are specified, provide materials and construction which are identical to those tested by Underwriters Laboratories or equivalent independent testing agencies acceptable to the Architect.
 - 1. Noise Reduction Coefficient (NRC): Ratings have been tested in compliance with ASTM C423.
 - 2. Ceiling Attenuation Class (CAC) : Ratings have been tested in accordance with ASTM E1414.
 - 3. Light Reflectance (LR): Ratings has been tested in compliance with ASTM C523.

2.4 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.5 ACOUSTICAL CEILING PANELS

- A. Ceiling Type ACT-01 panels: Random running bond pattern (refer to Reflected Ceiling Plans).
 - 1. Panel sizes:
 - a. 24 by 24 inch by 3/4 inch thick.
 - b. 24 by 48 inch by 3/4 inch thick.
 - 2. Panel edge: Panel edge: Shadowline tapered (SLT) edge.
 - 3. Description: ASTM E-1264 Type IV, Form 1 and 2, Pattern E, G, Class A flame spread.
 - 4. Color: White.
 - 5. Minimum light reflectance range: LR 0.89.
 - 6. Acoustical characteristics:
 - a. NRC: 0.70.
 - b. CAC: 35.
 - 7. Acceptable products:
 - a. 24 by 24 inch panels:
 - 1) Armstrong: "Ultima," Number 1912.
 - 2) CertainTeed product: "Symphony M," Number 1222B-OVT-1.
 - 3) USG product "Mars ClimaPlus," Number 86785.
 - b. 24 by 48 inch panels:
 - 1) Armstrong product "Ultima Tegular" product number 1915.
 - 2) Certainteed product "Symphony M" product number 1220BF-OVT-1.
 - 3) USG product "Mars Climaplus" with FLB edge, product number 88985.

- c. 12 by 24 inch by 3/4 inch thick (custom manufactured size, allow additional lead time).
 - d. 12 by 48 inch by 3/4 inch thick (custom manufactured size, allow additional lead time).
- B. Ceiling Type: ACT-02 panels.
 1. Panel Sizes: random running bond pattern.
 - a. 24 inch by 24 inch by 5/8 inch.
 - b. 24 inch by 48 inch by 5/8 inch.
 2. Edge Profile: Square Tegular Narrow.
 3. Composition: Mineral Wool.
 4. Color: White.
 5. Noise Reduction Coefficient (NRC): Not less than 0.85.
 6. Ceiling Attenuation Class (CAC): Not less than 35.
 7. Light Reflectance (LR): Not less than 0.80.
 8. Dimensional Stability: Sag resistant.
 9. Basis of Design: Armstrong World Industries, Inc., product "Calla 9/16" Square Tegular 2824WH" and "2825WH"
 - a. Rockfon. product "Tropic Square Tegular Narrow, SLN."
 - b. USG product "Mars High NRC with FLB Edge."
- C. Ceiling Type ACT-03 panels:
 1. Panel size: 24 by 24 inch by 1/2 inch thick.
 2. Panel edge: Compatible with 15/16" DX/DXL suspension.
 3. Description: ASTM E-1264 Type XX Form 2, Pattern G, Class A flame spread, solid panel, non-combustible, white.
 4. Color: Flat white.
 5. Acceptable products (arranged in random, sound diffusing pattern).
 - a. USG product "Geometrix 3 dimensional.
 - b. Certainteed: Product as approved by the Architect.
 - c. Armstrong: Product as approved by the Architect.
- D. Ceiling Type ACT-04 panels:
 1. Panel sizes:
 - a. 24 by 24 inch by 3/4 inch thick.
 - b. 24 by 48 inch by 3/4 inch thick.
 2. Panel edge: beveled tegular.
 3. Description: ASTM E-1264 Type IV Form 2, Pattern E, Class A flame spread, wet formed mineral fiber, non-directional fissured, fine textured panel, non-combustible, vinyl latex paint finish.
 4. Color: White.
 5. Minimum light reflectance: LR 0.86.
 6. Acoustical characteristics:

- a. CAC: 35.
- b. NRC: 0.70
- 7. Acceptable products or approved equal:
 - a. 24 by 24 inch panels:
 - 1) Basis of Design: Equal to Armstrong product "HealthZone Ultima with HumiGuard and BioBlock - Number 1936".
 - 2) Certainteed: Product as approved by the Architect.
 - 3) Armstrong: Product as approved by the Architect.
 - b. 24 by 48 inch panels:
 - 1) Basis of Design: Equal to Armstrong product "HealthZone Ultima with HumiGuard and BioBlock (Custom order sized tile, allow additional lead time).
 - 2) Certainteed: Product as approved by the Architect.
 - 3) Armstrong: Product as approved by the Architect.
- E. Ceiling Type: ACT-05 panels.
 - 1. Panel Sizes: random running bond pattern.
 - a. 24 by 24 inch by 5/8 inch thick.
 - b. 24 by 48 inch by 5/8 inch thick.
 - c. 12 by 24 inch by 5/8 inch thick (custom manufactured size).
 - d. 12 by 48 inch by 5/8 inch thick (custom manufactured size).
 - 2. Edge Profile: Square Tegular Narrow.
 - 3. Composition: Mineral Wool.
 - 4. Color: White.
 - 5. Noise Reduction Coefficient (NRC): Not less than 0.85.
 - 6. Ceiling Attenuation Class (CAC): Not less than 35.
 - 7. Light Reflectance (LR): Not less than 0.80.
 - 8. Dimensional Stability: Sag resistant.
 - 9. Basis of Design: Armstrong World Industries, Inc., product "Calla 9/16" Square Tegular"
 - a. Rockfon. product "Tropic Square Tegular Narrow, SLN."
 - b. USG product "Mars High NRC with FLB Edge."

2.6 CEILING GRIDS

- A. Ceiling grid for ACT-01, ACT-02, ACT-03, and ACT-05: 9/16 inch exposed tee grid in white color matching ceiling panel, furnished with hemmed edge wall molding; acceptable products are:
 - 1. Armstrong; 9/16" Suprafine Exposed Tee Grid.
 - 2. Rockphon North America (Chicago Metallic); Tempra 4000.
 - 3. USG; 9/16 Centricitee System.
- B. Type ACT-04 Ceiling grid: 15/16 inch exposed grid, aluminum capped prefinished steel tee suspension system (or all aluminum tee system), in white color matching ceiling tile. Provide with matching hemmed edge wall moldings having aluminum

capping or all aluminum edge trim. Exposed face color shall be white matching ceiling tile. Acceptable products are:

1. Armstrong: AL Prelude Plus Exposed Tee System
2. Rockphon North America (Chicago Metallic); 830 Series.
3. USG; DXLA series.

2.7 EDGE TRIM

- A. Trim Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Armstrong.
 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Armstrong World Industries, Inc., Lancaster, PA.
 - b. Certainteed Corporation, Valley Forge, PA.
 - c. National Gypsum Company, Charlotte NC.
 - d. USG Interiors Inc., (Donn®) Chicago, IL.
 - e. Chicago Metallic Corp., Chicago, IL
 - f. Hunter Douglas Architectural Products Inc., Norcross, GA.
- B. Trim Type T-1: Edge/wall moldings where ceiling abuts walls and drop down soffits: Stepped profile "shadow" molding compatible with exposed grid system and color matched, equal to Armstrong: model N°. 7873.
- C. Trim Type T-2: Edge Trim (straight and curved): having 3/4 inch bottom leg with reveal, and 1 inch high vertical leg, equal to Armstrong product "Axiom Classic, model N°.s "AXMSTR and AXMCUR".
- D. Trim Type T-3: Edge Trim (straight and curved), having 4 inch bottom leg with reveal and 1 inch high vertical leg, equal to Armstrong product "Axiom Classic, model N°.s "AX4STR and AX4CUR".
- E. Trim Type T-4: Extruded aluminum, two-sided pocked edge trim at windows shades, having 5 inch by 5 inch deep pocket, equal to Armstrong models "AXP255OSC and AXP255ISC."

2.8 ACCESSORIES

- A. Hanger attachments: Of the most appropriate types for the specific receiving surfaces.
- B. Hanger rods: Black finished hanger ½ inch diameter threaded rods at ACT "Cloud" locations. Frequency of attachment as recommended by the manufacturer. Rods shall be set back from ceiling edge a minimum of 4 feet.
- C. Hangers: ASTM A641 Soft temper, pre-stretched galvanized carbon steel wire, with a yield stress of at least 3 times design load, but not less than 12 gage.
- D. Retention clips (kitchen only):

1. Armstrong product number "0414,"
2. Chicago metallic product number "935"
3. USG product number "20428."

2.9 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.10 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Beginning of installation means acceptance of existing substrate and project conditions.

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.
- B. Surface Preparation:
 1. Carefully examine all receiving surfaces, to which attachments will be made hereunder, and determine the most practical way of making such attachments. Request Architect's approval of any attachment method which differs from that indicated on the approved shop drawings before proceeding with installation.
 2. Permit acoustical ceiling tile to reach room temperature and a stabilized moisture content prior to installation.

3.3 INSTALLATION

- A. Locate system on room axis, leaving equal sized border units of not less than one-half tile width.
- B. Install all components of the suspended grid systems in accordance with the manufacturer's instructions, the approved shop drawings, conforming to ASTM C-636 requirements. Ensure a deflection not to exceed 1/360 span of 48-inch simple span.
- C. Install specified edge moldings wherever ceilings intersect a wall or partition surface, and around all items having any dimension of 4 inches or more which penetrate the ceilings, including circular penetrations. Set moldings absolutely level, using as long lengths as practicable, and secure with fasteners recommended by manufacturer for the type of substrate.
 1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
 2. Screw-attach moldings to substrate at intervals not over 16 inches on center, and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.
- D. Install hanger attachments to overhead construction in accordance with the approved shop drawings, spacing the attachments not more than 48 inches on centers over location of each main tee member.
 1. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
 2. Install hanger wire to attachments with triple twists.

- E. Install main tees parallel to the long dimension of each area, spacing the tees 48 inches on centers. Secure the bottom of hanger wires through slots in the main tee members and tie with triple twists. Level the main tees as the work progresses.
- F. Uniformly space the cross tees at 24 inches on centers, and secure the cross tees into the main tees as recommended by the system manufacturer.
- G. Provide sealant at gaps between new acoustical ceiling edge angles and all irregular walls.
- H. Fit acoustical ceiling tile units in place, free from damaged edges or other defects detrimental to appearance and function. Install acoustical ceiling tile level, in uniform plane, and free from twist, warp or dents.
 - 1. Field cut tegular type tile with a tegular reveal at all edge conditions.
 - 2. Where required by governmental agencies having jurisdiction, install retention clips, provide two clips per ceiling panel installed on opposite sides of panel.

3.4 TOLERANCES

- A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.
- B. Maximum variation from plumb of grid members caused by eccentric loads: 2 degrees.

3.5 CLEANING

- A. Properly clean surfaces of panels and open grids free from dirt and handling marks. Wherever surfaces cannot be cleaned by normal methods or have defects, remove and replace with new components.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Clean work under provisions of Section 01 73 00 – EXECUTION.

3.6 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 09 64 66
WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Prepare substrates to receive flooring as required to ensure specified tolerance level for finish surface of all work required by this Section. Preparation work includes patching, smoothing and leveling substrate as specified under Section 09 05 60.
- B. The work of this Section consists of wood athletic flooring where shown on the Drawings, as specified herein, and as additionally required for a complete and proper installation. Work includes, but is not limited to the following.
 - 1. Provide sealants at all penetrations through the vapor barrier.
 - 2. Provide vapor retarder and new wood athletic flooring system at Gymnasium.
 - 3. Perform complete sanding and finishing operations for exposed to view surfaces of all wood flooring and other wood items to be furnished hereunder.
 - 4. Vented wall base and aluminum plate thresholds. Provide all complete coordination details at doorways, special conditions, including all special wall angles, strips and fillers.
 - 5. Painting of game lines at Gymnasium.
 - 6. Painting of Fuller Middle School "Falcons" logo, at Gymnasium center court.
 - 7. Provide additional support blocking, substrate system at the bleacher roller points.
- C. Install the following furnished under the designated Sections:
 - 1. Volleyball sleeves for standards, (uprights) at Gymnasium furnished under Section 11 66 23 – GYMNASIUM EQUIPMENT and installed under this Section 09 64 66.
 - 2. Floor sleeves, boxes, transitions furnished by other sections for installation under this Section 09 64 66.
- D. Finish wood strip flooring, wood athletic flooring, stair treads and risers, and nosing platform furnished by Sections 06 40 00 – ARCHITECTURAL WOODWORK, 09 64 29 – WOOD STRIP AND PLANK FLOORING, and 09 64 66 – WOOD ATHLETIC FLOORING.

1.3 RELATED SECTIONS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Preparation of concrete slab to receive sleeves, (inserts) for volleyball standards into floor.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for flooring work provided under this Section 09 68 13.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. FSC (Forest Stewardship Council): "FSC Certification Program"
 - 3. FS MM-L-736 - Lumber; Hardwood.
 - 4. NFSHSA - Basketball rule Book.
 - 5. NFSHSA - Volleyball rule Book.
 - 6. MFMA – Floor Finish List and Specifications
 - 7. MFMA – Sanding, Sealing, Court Lining and Finish Maple Gym Floors
 - 8. MFMA – Grading Rules
 - 9. WSFI - Recommendations for the Correct Preparation, Finishing, and Testing of Concrete Subfloor Surfaces to Receive Wood Flooring.
 - 10. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data for each type of wood flooring and finish system materials, with manufacturer's installation instructions and recommended maintenance procedures.
 - 2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC standards.

- 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
 - b. Composite Wood and Agrifiber Products: Include certification indicating compliance with the testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda for all composite wood and agrifiber products.
 3. Manufacturer's warranties: Wood flooring and finish system manufacturers' standard written guarantees covering defects in materials and workmanship, clearly defining the terms included in the coverage.
 4. Shop drawings:
 - a. Measured plan drawing indicating all game lines. Identify color of lines.
 - b. Large scale drawing of center court school logo.
 - c. Section showing vented base, and section showing transitions with abutting flooring materials.
 5. Verification samples: Finished 24 by 24 inch section of completed flooring with all components.
 6. Manufacturer's shall submit an independent third party suitability report indicating conformance with all performance criteria specified in DIN 18032 Part 2(2001), EN 14904, MFMA Standards.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Maintenance data: Include manufacturer's recommended maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping, and re-finishing, stain removal methods, and polishes and waxes.
 2. MFMA - Care and Preservation of Your Wood Floors.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer: Companies specializing in manufacturing the products specified in this Section, each with minimum 5 years documented experience.
 - B. Installer specializing in applying the work of this Section with a minimum of 5 years documented experience of the type of flooring system specified.
 - C. Perform work in accordance with MFMA.
 - D. Sustainability Standards Certifications:
 1. Chain of Custody wood products: All wood products furnished under this Specification Section shall be "FSC certified" according to the rules of the Forest Stewardship Council (FSC).
 - a. FSC Certification includes the following certification bodies of forests and forest products:

- 1) Certification Systems.
 - 2) SmartWood.
 - 3) SGS Qualifor.
 - 4) Soil Association.
- b. Wood products lacking acceptable documentation for Chain of Custody, will be rejected and their removal required.

1.7 REGULATORY REQUIREMENTS

- A. Conform to applicable codes for Class 1 flame spread rating of finished floor surface when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver wood flooring a minimum of 7 days prior to installation to allow materials moisture content to stabilize to ambient conditions. Do not deliver wood until all concrete, masonry, plaster and other wet work is complete and dry, and ambient air at installation space has moisture content stabilized.
- B. Protect wood flooring from excessive moisture in shipment and handling; store all materials in an elevated, protected, and dry location.

1.9 PROJECT CONDITIONS

- A. Maintain ambient temperature between 55 and 80 degrees Fahrenheit, with a relative humidity of between 35 and 50 percent for 48 hours prior to delivery and storage of the flooring materials at the area; maintain such conditions throughout the installation and finishing period, and thereafter until Owner's Final Acceptance or Owner's occupancy.

1.10 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure wood flooring is not delivered until building is enclosed, sufficient heat is provided, and proper humidity conditions can be maintained.
- B. Install wood flooring after interior wet work is complete and fully cured, and ambient air at installation space has a moisture content stabilized.

1.11 WARRANTIES

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 - WARRANTIES.
- B. Provide manufacturer's 5 year total system warranty (including vapor barrier) which shall include coverage for all costs to repair or replace flooring, which shrinks, warps, cracks, or otherwise deteriorates excessively, or which breaks its anchorage, or bond with substrate, or otherwise fails. Warranty shall cover failures due to materials or workmanship. The Installer is not responsible for failure due to excessive moisture penetration through concrete substrate or other similar causes for failure which are beyond the Work of this Section, except verification of acceptable substrates, specified herein.

PART 2 - PRODUCTS

2.1 FLOOR SYSTEM

- A. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Robbins, Inc, Wausau, WI products:
 - 1. Gymnasium floor: "Bio-Channel Star".
- B. Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Robbins, Inc., Cincinnati, OH, product "Bio-Channel Star".
 - 2. Action Floor Systems, Inc., Mercer WI, product "Anchor Flex".
 - 3. Aacer Floor Company, Peshtigo, WI, product "Aacer Channel VLP".
 - 4. Connor Sport Court International, Amasa, MN, product "Connor S Channel".
 - 5. Horner Flooring Co. Dollar Bay, MI

2.2 FLOORING MATERIALS

- A. Sustainable Forest Certification: All wood shall be "Chain-of-Custody" certified as FSC Certified.
- B. Vapor barrier: Free-standing, dimensionally stable, 4-ply composite product, engineered as a moisture suppression membrane for use on concrete complying with the following requirements:
 - 1. Mold, mildew and fungal resistance when tested in accordance with ASTM D3273: 10 rating
 - 2. Moisture Vapor Transmission rate when tested in accordance with ASTM E96: less than 0.01 g/hrs/m²
 - 3. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Halex Corporation, Ontario, CA, product "VersaShield MBX Flooring Underlayment" or approved equal.
- C. Flooring Channels: Equal to Robbins Bio-Channels consisting of a 1-1/2 by 2-5/8 inch by 8'-0" wood engineered wood sleeper with EPDM cushion attached, factory encased in a steel channel. Sleeper must be free to move vertically within steel channel confines to assure proper uniformity of resiliency and function.
 - 1. EPDM Cushion: minimum 7/16 inch (11 mm) thick double-trapezoidal shaped EPDM rubber with reverse cavity having non-coextensive lower and upper surfaces.
- D. Subfloor: Robbins Bio-Cradle engineered factory-assembled subfloor with 7/16" EPDM Bio-Pads factory attached.
- E. Flooring: Nominal 3/4 inch 25/32 inch) thick by 1-1/2 inches wide kiln-dried plain sawn Northern Hard Maple (*Acer Saccharum*), MFMA grade-marked, tongue and grooved, and delivered to the project in bundles bearing the specified grade marking.

1. Grade: MFMA Second and Better Grade, Mixed Grain, TGEM, KN.
2. Individual strip length: Random lengths, ranging from a minimum of 9 inches to a maximum of 102 inches. Proportion of board lengths shall be in accordance with specified MFMA grade.
3. Floor edgings: Plain sawn solid White Hard Maple, AWI Custom Grade, of sizes and profiles indicated on the Drawings.

F. Fasteners:

1. Flooring: 1-3/5 inch (45mm) barbed cleats or equivalent.
2. Subfloor: 1-5/8 to 1-3/4 inch (40mm) subflooring nails or staples.
3. Channel anchors: 1-1/4 inch (35mm) long steel power actuated or pneumatic anchors.
4. Bio-Cradles: 1 inch (25mm) length, 7/16 inch (11mm) crown, coated staples or equivalent.
5. Bio-Cradle anchors: Equal to Robbins POSI-ANCHOR® with sleeve.

2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
1. Ardex, Inc., products: "Feather Flash" and "Ardex SD-P".
 2. Bonsal American, Charlotte, NC, product: "Pro Spec – Floor Pach Pro".
 3. Quikrete Companies, product: "Fast-Set Underlayment 1248".
 4. Silpro Masonry Systems Inc., product: "Profinish".
 5. Accessories:
 - a. Primers: Unless otherwise recommended by cementitious underlayment and patching mortar manufacturer for substrate material, condition, and porosity encountered:
 - 1) Ardex: "P-51".
 - 2) Pro Spec: "Level Set Primer".
 - 3) Silpro: "C 21 All Acrylic".
 - b. Cleaning agent: Commercial Muriatic acid.
 - c. Provide accessories from the same manufacturer as patching and filling compounds as approved by the Architect.
- B. Wall base: Vented molded rubber cover base, 4 by 3 inches with premolded outside corners as supplied by flooring manufacturer.
- C. Sheathing protection paper: Red Rosin or Waxed kraft paper.
- D. Fasteners:
1. Fasteners for underlayment: Power-actuated fasteners of appropriate size for the specific substrate.
 2. Fasteners for flooring: 7d or 8d cut nails or screw-type nails, or other fasteners as recommended by the flooring manufacturer, for blind-method installation over plywood underlayment.

- E. Filler for patching, smoothing and leveling subfloors and underlayment: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:
 - 1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
 - 2. Quikrete Companies, product "Fast-Set Underlayment 1248".
 - 3. Silpro Masonry Systems Inc., product "Masco Latex Cement"

2.4 FINISHING

- A. Sandpaper: Number 1-1/2 graduating to 1/2; followed by Numbers 0 and 00 for final sanding, except as otherwise recommended by the flooring manufacturer.
- B. Filler: Paste wood filler, in tone as selected by the Architect.
- C. Floor finish: MFMA Group 3 Surface Finish complying with the following requirements:
 - 1. Non-Volatile Content: 40%-60%
 - 2. Viscosity: A-C
 - 3. Flash Point: $\geq 38^{\circ}\text{C}$ (100°F)
 - 4. Gloss: ≥ 90
 - 5. Color : Shall not be darker than Gardner Color Standard, number 12
 - 6. Dry Film Color : Upon comparison, an oven-aged panel should not have darkened when compared to an unexposed panel.
 - 7. Package Stability: All Groups shall be free from sediment and suspended solid matter (Group 1 sanding sealers need not meet this requirement). All groups shall be resistant to skinning and show no color change after aging.
 - 8. Dry Time: Shall set to touch in not less than one hour nor more than three hours. They shall dry hard for re-coat or service in less than seven hours without developing tackiness.
 - a. Shall spread easily 15 minutes after coating.
 - b. Shall show no evidence of tackiness
 - 9. Hardness (Sward Hardness Rocker)- Tested seven days after applications. Must exhibit a minimum hardness of 30
 - 10. Abrasion Resistance –Sand Coefficient - ≥ 120 – James Machine Weight loss shall not exceed 1% - Black Heel mark Resistance – All products must have a minimum rating of excellent.
 - 11. Flexibility: pass the 1/8" mandrel Test. No cracking shall occur between points 1/4" inch from each side of the panel.
 - 12. Adhesion: provide good adhesion properties when recoated after 24 hours.
 - 13. Maintenance –easily removed by using conventional physical or chemical methods. Shall be capable of blending with patched worn areas.
 - 14. Stain Resistance – Shall show no whitening, no more than very slight dulling and no other visible defects when exposed to the following staining agents: Distilled Water, Light duty, all-purpose cleaner (Spic & Span®), 1% solution in water), Vegetable Oil.

15. Alcohol, Naphtha, Beer and Coca-Cola® Resistance – Shall show no evidence of damage, dulling or whitening by the introduction of a 50% alcohol/water solution, Naphtha, Beer and Coca-Cola®.
 16. Perspiration Resistance – Shall exhibit no discoloration or loss of adhesion by the introduction of synthetic perspiration.
 17. Coefficient of Friction – Must achieve a minimum Coefficient of Friction reading of 0.50.
- D. Painting:
1. Provide game lines in 4 colors, to define the following:
 - a. One Full basketball court.
 - b. Two half-court practice basketball courts.
 - 1) Line color for practice courts: light gray.
 - c. One full-court volleyball court.
 2. Provide 4 color graphic for Fuller Middle School 'Falcons' mascot logo at center court. Overall size is indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify concrete substrate has cured for at least 60 days. Test concrete with 3 percent solution of phenolphthalein in grain alcohol for dryness. Do not proceed with installation until substrate passes dryness test, immediately notify Architect of unacceptable substrate conditions.
- B. Verify that permanent heat, light, and ventilation is complete and operational prior to installation.
- C. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Verify that concrete substrate surfaces are smooth and flat to plus or minus 1/8 inch in 10 feet, free of scaling, oil, grease, dust, and foreign substance.
 2. Verify that wood subfloor is properly secured, is smooth and flat to plus or minus 1/8 inch in 10 feet, free of foreign substances.
- D. Verify that required flooring mounted utilities are in proper location.
- E. Beginning of installation means acceptance of site conditions.

3.2 PREPARATION

- A. Comply with flooring manufacturer's requirements for preparation of substrate to receive wood flooring.
- B. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.
- C. Surface Preparation:

1. Remove by mechanical means (light sanding and grinding), all protruding edges, high spots. Ensure that substrate is free from paint, varnish, wax, oil, or other foreign matter. Do not use solvents.
 2. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler. Apply, trowel and float finish subfloor filler and leave a smooth, level, hard surface. Prohibit traffic from area until filler is cured.
 3. Apply troweled subfloor filler and leveler to provide finished concrete surface smooth, with no more than 1/8 inch variation from plane within 10 feet in any direction.
 - a. Prohibit traffic until filler and leveler is cured.
 4. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.
- D. Apply primers as recommended by adhesive manufacturer's written instructions.
- E. Open bundles of flooring, and permit the pieces to properly acclimatize prior to installing same.
1. Condition flooring materials, accessories and adhesives to room temperatures for a period of 48 hours minimum.

3.3 INSTALLATION - GENERAL

- A. General Install in accordance with manufacturer's instructions. Arrange strips with staggered end joints and end grain, matched, set joints flush and tight.
- B. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar. Provide divider strips.
- C. Flooring System:
1. Membrane: Install polyethylene film with joints lapped and taped a minimum of 6".
 2. Install Resilient-pads to bottom of 1st layer of sub-floor in accordance with manufacturer's instructions.
 3. Install 2 layers of subfloor opposite to each other at a 45 degree angle to the flooring as recommended by the floor manufacturer.
- D. Fill voids between sleepers with specified mineral wool insulation, full depth.
- E. Flooring:
1. Wood flooring shall be laid with fine hairline joints and not driven up tightly except for low humidity regions. Provide a 2" minimum expansion void at perimeter and at vertical obstructions.

3.4 INSTALLATION - VOLLEYBALL SLEEVES

- A. Volleyball sleeves: Install volleyball system in accordance with manufacturer's instructions.
1. Coordinate installation of floor sleeves with other trades.
 2. Install floor sleeves to accommodate standards plumb and at equal height.
 3. Grout volleyball sleeves in place at concrete substrate.

3.5 SANDING AND FINISHING PREPARATION

- A. Mask off adjacent surfaces and take precautions to contain dust.
- B. Sand flooring including facings, and edgings, after installation of flooring and repairs, and after adjacent work is completed.
 - 1. Sanding: Sand flooring with drum sander, edger, buffer and hand scraper.
 - a. Use a power sander, taking precautions to contain dust, sand flooring in several complete passes, commencing with 1-1/2 graduating to 1/2; followed by Numbers 0 and 00 for final sanding.
 - b. After sanding, buff entire floor using 100 grit screen back or equal grit sandpaper with a heavy-duty buffing machine.
 - c. Vacuum and/or tack floor before first coat of sealer.
 - d. Floor shall present a smooth surface without drum stop marks, gouges, streaks or shiners.
- C. Sand all flooring, facings, edgings, stair treads and risers, and nosings after installation of flooring and when adjacent work is complete. Leave floor finish with no evidence of sander marks. Fill all nail holes with appropriate wood filler for blending into finish floor. Take precautions to contain dust and leave floor finish with no evidence of sander marks.
- D. Thoroughly vacuum-clean all sanded surfaces and other finish surfaces within space, clean surfaces completely free from dust, and dry-mop with a tack cloth-clad mop.

3.6 FINISHING

- A. Prior to commencing application of finishing products, measure moisture content of flooring using moisture meter, and record results.
- B. Stain wood to color and tone to match architect's accepted sample, applying stain at approximately 100 square feet per gallon; allow stain to fully dry, verify with moisture meter.
- C. When stain has cured, apply one coat of Basic Coatings product "Hydroline sealer" as recommended by manufacturer. When that moisture content of wood is same as original prior to application, sand/buff coat with a used 120 grit screen.
- D. Vacuum up all dust and tack with a clean water dampened towel. Apply second coat of sealer and, repeat sanding and cleaning procedures.
- E. Permit sealer to dry overnight prior to finishing with catalyzed urethane. Re-sand and clean as required.
- F. Mix catalyst with urethane in strict adherence to manufacturers' instructions. Apply one coat of catalyzed urethane with a coverage rate as recommended by manufacturer. When manufacturer recommends first coat should be dry, check the moisture content of wood. When moisture content is same as original prior to application, sand with used 120 grit screen, clean and apply second coat. This should occur between 3 and 5 hours after first coat. If more than 5 hours has lapsed prior to starting the second coat of urethane, repeat sanding and cleaning procedures specified above and apply second coat.

- G. Installation of Perimeter Molding and thresholds.
 - 1. Install aluminum threshold or screws and anchors, plumb and at equal height.
 - 2. Install vented cove base anchored to walls with recommended adhesive, screws, or anchors. Use pre-molded outside corners and neatly miter inside corners.

3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of scraps and sawdust.
- B. As work progresses, remove excess adhesive from floor, base and wall surfaces without damage.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Clean and polish floor surfaces in accordance with manufacturer's instructions.
- E. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.8 PROTECTION

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
 - 1. Prohibit traffic from flooring areas for 48 hours after installation.
 - 2. Maintain protection of wood athletic flooring until Project Substantial Completion. Flooring shall be without any indication of deterioration, wear, or damage at time of completion.
- B. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. Cover all floor surfaces with fire-resistant temporary floor protection, taping the edges to maintain position of the protection paper. Reapply protection materials as required to maintain floor protection.

End of Section

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Section 09 65 13
RESILIENT BASE AND ACCESSORIES
(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 06)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. Prepare substrate to receive resilient base.
- B. Furnish and install the following:
 - 1. Coved resilient base.
 - 2. Straight (non-coved) resilient base.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient base.
- D. Section 06 10 00 - ROUGH CARPENTRY: Plywood wood blocking and nailers .
- E. Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection of resilient flooring systems.
- F. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate to receive resilient base.
- G. Section 09 65 43 – LINOLEUM FLOORING: Linoleum tile and sheet flooring
- H. Section 09 68 13 – TILE CARPETING: Carpet tile and transition strips.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. ASTM F 1861 - Standard Specification for Resilient Wall Base
3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all adhesives. Submit MSDS highlighting VOC limits.
2. Selection Samples: Manufacturers' sample chain of colors available for selection by Architect.
3. Verification Samples: Each type resilient base and color selected, 24 inches long.

B. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.

1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal 24 linear feet for each color and type of resilient base installed.

1.7 QUALITY ASSURANCE

- ##### A. General: Avoid color and pattern differential; provide base from one production run in any single room or contiguous areas.

1.8 DELIVERY, STORAGE AND HANDLING

- ##### A. Delivery and Acceptance Requirements:

1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
2. Deliver resilient base materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.

B. Storage and Handling Requirements:

1. Store materials in a clean dry, enclosed space off the ground and protected from the weather. Protect adhesives from freezing.

1.9 SITE CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty:
1. Resilient Base: Provide manufacturer's standard one year limited product warranty for resilient base materials.
 2. Adhesives: Provide manufacturer's one year limited product warranty for adhesion reliability.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Johnsonite, Middlefield OH.
 2. Burke-Mercer Products Company, San Jose CA.
 3. Roppe Corporation, Fostoria OH.
 4. VPI Corporation, Sheboygan WI.
 5. Tarkett, Inc., Parsippany NH.

2.3 DESCRIPTION

- A. Regulatory Requirements:

1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of base trim in accordance with ASTM E 84.

2.4 RESILIENT BASE

- A. Rubber Base: 4 inches high, ribbed back, 1/8 inch thick, rounded top complying with ASTM F-1861, Type TP, Thermoplastic Rubber (TBR). Colors shall be as selected. Rubber base shall be furnished in continuous lengths, approximately 100 feet long.
 1. Provide coved base at resilient flooring.
 2. Coved base at sealed concrete floors, and back-of-house spaces not having a finished floor.
 3. Provide straight (non-coved) base at carpeted and walk-off entrance mat areas.
- B. Base accessories: Premolded end stops of same material, size and color as base. Job-form all external and internal corners from base material, pre-molded corner pieces will not be acceptable

2.5 ACCESSORIES

- A. Adhesives
 1. General: Water resistant, low VOC, acceptable to the resilient flooring manufacturer, for substrate conditions.
 - a. Cove Base Adhesives: Maximum VOC 50 [g/L less water]
 2. Acceptable manufacturers:
 - a. Advanced Adhesive Technology, Inc, Dalton GA, product: "No. 432 Modified Acrylic Cove Base Adhesive".
 - b. DAP Incorporated, Dayton OH, product: "Cove Base Construction Adhesive".
 - c. W.W. Henry Company, Aliquippa PA., product: "Henry 440 Cove Base Adhesive".
 - d. Roberts Consolidated Industries, Inc., City of Industry, CA, product: "Premium Solvent-Free Cove Base Adhesive".
- B. Joint Sealer for between the top of wall base and irregular wall surfaces: Plastic filler as recommended by manufacturer.
- C. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

- C. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Install Resilient base: Install base on solid backing, bond to vertical substrate with continuous contact at horizontal and vertical surfaces. Apply wall base to walls, columns, casework and other permanent fixtures in areas where base is required.
 - 1. Install in lengths as long as practical.
 - 2. Scribe to fit to door frames and other interruptions.
 - 3. Form all external and internal corners in accordance with manufacturer's written instructions. Cope inside corners and fit neatly.
 - 4. Fill voids with plastic filler along the top edge of the resilient wall base on masonry surfaces or other similar irregular substrates.

3.3 CLEANING

- A. Comply with requirements of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.
- B. Post-installation Cleaning: As installation progresses, continually remove excess adhesive from floor, base and wall surfaces without damage.

End of Section

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Section 09 65 43
LINOLEUM FLOORING
(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 06)

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract Requirements: As provided under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Trade Contract includes all individual specification sections listed in Section 09 00 06.

1.2 SUMMARY

- A. General: The work of this Section consists of linoleum flooring where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.
- B. Furnish and install the following:
1. Linoleum tile flooring.
 2. Linoleum tile flooring installed as wall base.
 3. Acoustical underlayment at Second and Third Floor Classrooms.
 4. Control joints in linoleum flooring.
 5. Transition strips wherever edges of resilient flooring materials abut dissimilar flooring, where no thresholds occur.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate 1 affects the scope of work of this Section 09 65 43.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete substrate for resilient flooring, and concrete sealers.
- E. Section 09 00 06 – RESILIENT FLOORING TRADE REQUIREMENTS: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection for the work of this Section 09 65 19.
- F. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary

protection, for flooring work NOT provided under the Resilient Flooring Trade Contract.

- G. Section 09 30 00 - TILING: Ceramic tile flooring and marble thresholds.
- H. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Resilient base provided under the Resilient Flooring Trade Contract.
- I. Division 26 - ELECTRICAL: In-floor electrical receptacles.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 2. ASTM F-710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - 3. ASTM F-1869 – Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
 - 4. ASTM F-2034 – Sheet Linoleum Floor Covering
 - 5. ASTM F-2195 –Linoleum Floor Tile
 - 6. NFPA 253 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 7. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 00 06 – RESILIENT FLOORING TRADE CONTRACT REQUIREMENTS.
- B. Sequencing:
 - 1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
 - 2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.

- a. Furnish manufacturer's product literature on flooring adhesive, highlight adhesive properties, including VOC's and maximum moisture pressure limits for substrates.
 2. Shop drawings: 1/4 inch scale plans of each flooring area scheduled for Work of this Section. Drawings shall bear dimensions of actual measurements taken at the project.
 - a. Indicate layout of tile units and direction of tile patterns.
 - b. Identify selected colors and patterns.
 - c. Show location of joints with abutting materials.
 - d. Show locations and types of reducer and edge strips.
 - e. Where more than one adhesive type is specified or otherwise required by flooring manufacturer, identify on shop drawings areas for each adhesive type.
 3. Selection samples: Manufacturers' sample chain of colors and patterns available for selection by Architect.
 4. Verification samples:
 - a. Sheet flooring: 12 by 12 inch illustrating color, and pattern for each color and type of flooring selected.
 - b. Full sized flooring tile, illustrating color, and pattern for each color and type of tile selected.
 - c. Edging: 12 inches long demonstrating profile, thickness, size and color.
 5. Certificates:
 - a. Submit the manufacturer's certification that the resilient flooring has been tested by an independent laboratory and complies with the required fire tests.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Operation and Maintenance Data: Furnish cleaning and maintenance data.
 2. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra flooring materials for future repairs and maintenance, from the same manufacturing runs as those installed, in the following amounts.
 - a. Linoleum flooring: 3 percent of each material in each color, and pattern installed.
 - b. Furnish a quantity of adhesive of each type used in sealed cans or containers sufficient to apply the above materials.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
 - 1. Provide types of resilient tile and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.
 - 2. Avoid color and pattern differential; provide flooring from one production run in any single room or contiguous areas.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Do not deliver flooring materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 - 3. Deliver resilient flooring materials in original, unopened packages and store protected for three days prior to installation in area of installation to achieve temperature stability.
- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets. Store materials in a clean dry, enclosed space off the ground and protected from the weather
 - 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - 3. Protect adhesives from freezing.
- C. Packaging Waste Management: Comply with packaging requirements specified under Section 01 60 00 - Product Requirements.
 - 1. Shipping materials: Manufacturer shall utilize to the greatest extent possible packaging materials which are biodegradable and recyclable.
 - 2. Jobsite packaging waste management: Recycle packaging materials coordinated with general construction waste management specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

1.9 SITE CONDITIONS

- A. Maintain uniform temperature of minimum of 65 degrees Fahrenheit and humidity of 20 to 40 percent 48 hours prior to, during, and 48 hours after installation. Store resilient flooring materials and accessories in the spaces where they will be installed for at least 48 hours before beginning installation. Thereafter, maintain a minimum temperature of 55 degrees Fahrenheit in the areas where the work is completed.

1.10 WARRANTY

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1. Manufacturer Warranty: provide manufacturer's standard wear warranties for all flooring and stair tread materials installed under this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Forbo Industries Inc., Hazleton PA.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Linoleum Flooring:
 - a. Forbo Industries Inc., Hazleton PA.
 - b. Johnsonite Inc., Chagrin Falls OH.
 - c. Or approved equal.
 2. Adhesives:
 - a. Advanced Adhesive Technology, Inc, Dalton GA.
 - b. DAP Incorporated, Dayton OH.
 - c. W.W. Henry Company, Aliquippa PA.
 - d. Roberts Consolidated Industries, Inc., City of Industry, CA.

2.2 DESCRIPTION

- A. Regulatory Requirements:
 1. Provide materials and assemblies conforming to applicable building codes and regulatory agencies for flame/fuel/smoke rating requirements of flooring in accordance with ASTM E 84.
 2. Provide flooring material to meet the following fire test performance criteria as tested by a recognized independent testing laboratory:
 - a. ASTM E 648 (Critical Radiant Flux) of 0.45 watts per sq. cm. or greater, Class 1.
 - b. ASTM E 662 (Smoke Generation) Maximum Specified Optical Density of 450 or less.
- B. Sustainability Requirements:
 1. Biobased Material: Consisting of oxidized linseed or other vegetable drying oil and rosin, mixed with ground cork or wood flour, mineral filler, and natural pigments. Mixture shall be bonded and keyed to a burlap (jute) or other suitable fibrous backing so that backing is partially embedded in mixture.
 2. Product shall be completely biodegradable.

2.3 LINOLEUM TILE FLOORING

- A. Linoleum tile flooring: Marbleized linoleum, all natural resilient, self-sanitizing, bactericidal flooring of primarily natural materials consisting of linseed oil, wood flour, and rosin binders, mixed and calendared onto a polyester backing. Total

construction non-asbestos. Pattern and color shall extend throughout total thickness of wear surface. Products which may be incorporated in the work include the following:

1. Forbo Industries Inc., Hazleton PA, products
 - a. Linoleum Tile: "Marmoleum Composition Tile (MCT 2.0mm)". Color "Stone, number 3888.
2. Johnsonite Inc., Chagrin Falls OH, product "Harmonium xf Veneto" in color matching Basis of Design product..
3. Or approved equal.

B. Linoleum Physical Characteristics

1. Tile Size: nominal 13 by 13 inches (33.3 cm x 33.3 cm).
 - a. Tile size at base to be custom cut for 12 inch height.
2. Gauge: 0.080 inches (2.0 mm).
3. Backing: Polyester backing.

C. Color and patterns as indicated on Drawings, where not indicated, as selected by Architect from full available range.

2.4 ACCESSORIES

A. Control joints in linoleum flooring: Stainless steel surface joint with ¼ inch width, thermoplastic rubber movement zone:

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Schlüter Systems L.P., model Dilex-EKSB.
2. Acceptable Manufacturers:
 - a. Schlüter Systems L.P., Plattsburgh NY.
 - b. Custom Building Products, Inc., Seal Beach, CA.
 - c. Ceramic Tool Company Inc., Waukesha WI.

B. Filler for patching, smoothing and leveling subfloors and underlayments: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:

1. Ardex Americas, Aliquippa, PA. products "Feather Flash" and "Ardex SD-P".
2. Quikrete Companies, product "Fast-Set Underlayment 1248".
3. Silpro Masonry Systems Inc., product "Profinish".

C. Adhesives

1. General: Water resistant, acceptable to the resilient flooring manufacturer, for substrate conditions.
2. VOC content: Less than 50 g/L.
3. Acceptable manufacturers, or approved equal:
 - a. Advanced Adhesive Technology, Inc, Dalton GA.
 - b. DAP Incorporated, Dayton OH.
 - c. W.W. Henry Company, Aliquippa PA.

- d. Roberts Consolidated Industries, Inc., City of Industry, CA.
 - e. Or adhesive recommended by flooring manufacturer for performance and compliance with warranty requirements.
- D. Adhesives for linoleum tile flooring system: Polyurethane based, NFPA Class A rated, VOC compliant, as recommended by manufacturer.
- E. Acoustical Underlayment (at Second and Third Floors): Forbo product number MR 99.
- F. Cleaning material: Domestic neutral floor detergent having a pH 7 or pH 8, as recommended by the flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Surface Preparation:
- 1. Remove by mechanical means (light sanding and grinding), all protruding edges, high spots. Ensure that substrate is free from paint, varnish, wax, oil, existing adhesive residue, or other foreign matter. Do not use solvents.
 - 2. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler. Apply, trowel and float finish subfloor filler and leave a smooth, level, hard surface. Prohibit traffic from area until filler is cured.
 - 3. Apply troweled subfloor filler and leveler to provide finished concrete surface smooth, with no more than 1/8 inch variation from plane within 10 feet in any direction.
 - a. Prohibit traffic until filler and leveler is cured.
 - 4. Vacuum clean substrate, and ensure that substrate is dry, clean and smooth prior to application of flooring.
- C. Pre-installation off-gassing ventilation: Ventilate flooring products prior to installation. Open packaging, or remove from packaging, and ventilate flooring in a secure, dry, well-ventilated space free from contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree F maximum continuously for not less than 72 hours.
- 1. Do not ventilate within limits of Work unless otherwise approved by Architect.

3.3 INSTALLATION - GENERAL

- A. Install all products in strict accordance with each manufacturer's written installation procedures and other provisions specified herein.

1. Apply primers as recommended by adhesive manufacturer's written instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Mix tile to ensure that concentration of surface patterns is uniform throughout. Use tile from cartons in same sequence as manufactured and packaged, if so numbered.
- D. Maintain reference markers, holes and openings that are in place or have been marked for future cutting; repeat markers on flooring as marked on substrate. Use non-permanent marking devices which may be cleaning washed off when no longer required.

3.4 INSTALLATION - FLOOR TILE

- A. Lay flooring in a 1/3 running grid pattern, with joints and seams parallel to building lines. Lay tile flooring in pattern as indicated on the drawings or if not indicated as such, lay pattern-grain in singular direction. Lay tile with joints straight and continuous in both directions and with border tile not less than 1/2 the width of the tile.
- B. Neatly fit resilient materials to all intersecting surfaces, and make joints as inconspicuous as possible.
- C. Terminate flooring at centerline of door in closed position where adjacent floor finish is of different material, color, or orientation. Where flooring pattern continues through door openings, continue established pattern with no interruption.
- D. Apply resilient materials to have uniform contact with receiving surfaces throughout, with tight joints, and with all finish surfaces smooth, in true plane, free from buckles, waves, and other imperfections.
- E. Extend resilient flooring to wall lines beneath all movable equipment and movable casework. Fit resilient flooring onto breaks and recesses, against non-resilient bases, around pipes and other protrusions, under saddles, and to and around other fixed surfaces, making neat cuts in the flooring and minimizing joints.

3.5 INSTALLATION OF ACCESSORIES

- A. Resilient edge and transition strips:
 1. Install edge strips at all edges of flooring which would otherwise be exposed.
 - a. Secure metal edge strips to the substrate with countersunk stainless steel anchors, complying with the edge strip manufacturer's recommendations.
 2. Place resilient edge strips tightly butted to flooring and secure with adhesive recommended by the edge strip manufacturer.

3.6 CLEANING

- A. General: Comply with requirements of Section 01 73 00 – EXECUTION for periodic and final cleaning, and as additionally specified herein. Comply with requirements

of Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL for handling and disposition of all construction and demolition waste.

1. Control accumulation of waste materials and trash. Daily clean work areas by sweeping and disposing of debris, and scraps.

B. Post-installation Cleaning:

1. As installation progresses, continually remove excess adhesive from floor, and wall surfaces without damage.
 - a. Protect installed flooring as recommended by the flooring manufacturer against damage from rolling loads, other trades, or the placement of fixtures and furnishings.
2. Sweep floors to remove all loose dirt and debris.
3. After specified waiting period, clean all materials installed hereunder with a non-abrasive commercial detergent approved by the material manufacturers, and thoroughly rinse with clear water.
 - a. Linoleum floors: Wait at least 5 full days following completion of installation before commencing with cleaning.

C. Final Cleaning:

1. General: Perform final cleaning not before 4 days prior to Owner's intended occupancy date.
2. Linoleum floors:
 - a. Scrub floors using a one disc scrubbing machine with green nylon pad and water to which a neutral cleaning agent (less than pH9) has been added.
 - b. Rinse thoroughly and let dry
 - c. Apply manufacturer's recommended spray cleaning fluid containing 5 percent natural wax and no polymers. Dust wipe or dry mop.

3.7 PROTECTION

- A. General: Protect finished work under provisions Section 09 00 06 – RESILIENT FLOORING FILED SUB-BID REQUIREMENTS.
- B. Prohibit traffic on finished floor areas until flooring adhesive has fully set.
- C. Prohibit washing, scrubbing or other similar 'wet' operations to occur on finished floor areas for a minimum period of 5 calendar days after installation.
- D. Provide protection of completed flooring areas from construction traffic until Substantial Completion of the General Contract. After cleaning and polishing, cover all resilient floor surfaces with non-staining protection sheeting.. Reapply protecton as required to maintain floor protection.

End of Section

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Section 09 67 23
RESINOUS FLOORING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. General: The work of this Section consists of resinous flooring where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of resinous flooring, and temporary protection until Owner's acceptance.
- B. Prepare surfaces to receive resinous flooring.
- C. Apply resinous flooring system with an integral waterproof base turned up at walls, bases, pipe sleeves and equipment pads.
 - 1. Provide subsequent flooring system touch-up and repairs as required to provide a complete seamless molded waterproof system.
 - 2. At indicated locations, provide resinous wainscot to height (goes up 6'-0").

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 07 92 00 - JOINT SEALANTS: Requirements for sealants and backing materials.
- D. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for flooring work provided under this Section 09 67 23.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM C 307 - Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacing.
2. ASTM C 903 - Preparing Refractory Castable Specimens by Cold Gunning.
3. ASTM D 412 - Vulcanized Rubber and Thermoplastic Elastomers—Tension.
4. ASTM D 570 - Water Absorption of Plastics.
5. ASTM D 2240 - Rubber Property - Durometer Hardness.
6. ASTM D 5420 - Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
7. ASTM E 84 - Surface Burning Characteristics of Building Materials.
8. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING
- B. Sequencing:
 1. Sequence work to ensure resilient flooring is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
 2. Ensure that installation of flooring and accessories occurs after other finishing operations, including painting.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 – SUBMITTAL REQUIREMENTS:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all products to be applied hereunder
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all floor system components.
 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, integral base, and perimeter conditions.
 - a. The manufacturer's recommended methods of installation, when approved by the Architect, will be come the basis for inspecting and accepting or rejecting actual installation methods used on the Work.
 3. Certification: Material certificates signed by manufacturer certifying that the waterproof mechanical equipment room flooring complies with requirements specified herein.
 4. Selection samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 5. Verification samples:

- a. Samples of each level of slip resistance, aggregate, and pattern available in the specified products from the proposed manufacturer.
 - b. 12 x 12 inch samples of finished surface illustrating material color, texture and finish.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
 2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.

1.7 QUALITY ASSURANCE

- A. Single-Source Responsibility: Obtain resinous flooring materials, including primers, resins, and finish coats, from a single manufacturer.
- B. Qualifications:
1. Applicator: Company specializing in performance of the work of this Section with 5 years minimum documented experience having installers trained by manufacturer in installing resinous flooring types similar to that required for this Project, and who is acceptable to manufacturer of primary materials.
- C. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.
- D. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.
- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.
- C. Store materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.
- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.9 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Apply flooring materials within temperature and humidity range specified by coating manufacturer.
- C. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer and Flooring System: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Dur-a-Flex "Hybri-Flex EQ".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Dur-a-Flex Inc., East Hartford Ct.
 - 2. Atlas Minerals and Chemicals, Mertztown, PA.
 - 3. Crossfield Products Corp. (Dex-o-Tex), Roselle Park, NJ.
 - 4. General Polymers Corporation, Cincinnati OH. .
 - 5. Master Builders Inc., Cleveland OH.
 - 6. Stonhard Inc., Maple Shade, NJ.

2.2 FLOORING SYSTEM

- A. Self-leveling broadcast quartz, epoxy/aliphatic urethane topcoat seamless flooring system complying with the following minimum standards for physical characteristics:
 - 1. System Materials:
 - a. Topping: Equal to Dur-A-Flex, Inc, Poly-Crete MD resin, hardener and SL aggregate.
 - b. Broadcast aggregate: Equal to Dur-A-Flex, Inc. Q28 quartz aggregate.
 - c. Broadcast: Equal to Dur-A-Flex, Inc. Dur-A-Glaze #4, epoxy based two-component resin.
 - d. Grout coat: Equal to Dur-A-Flex, Inc Dur-A-Glaze #4, epoxy-based, two-component resin.
 - e. Top coat: Equal to Dur-A-Flex, Inc. Armor Top aliphatic urethane two-component resin.
 - 2. Patch Materials:
 - a. Shallow Fill and Patching: Equal to Dur-A-Flex, Inc. Poly-Crete MD (up to ¼ inch).

- b. Deep Fill and Sloping Material (over ¼ inch): Equal to Dur-A-Flex, Inc. Poly-Crete WR.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 PRODUCT REQUIREMENTS

- A. Topping:
- | | |
|--|---------------------------|
| 1. Percent Reactive | 100 % |
| 2. VOC | 0 g/L |
| 3. Bond Strength to Concrete ASTM D 4541 | 400 psi, substrates fails |
| 4. Compressive Strength, ASTM C 579 | 9,000 psi |
| 5. Tensile Strength, ASTM D 638 | 2,175 psi |
| 6. Flexural Strength, ASTM D 790 | 5,076 psi |
| 7. Impact Resistance @ 125 mils, MIL D-3134, | 160 inch lbs |
| 8. No visible damage or deterioration | |
- B. Broadcast Coat:
- | | |
|--|------------------------------|
| 1. Percent Reactive | 100 % |
| 2. VOC | <4 g/L |
| 3. Water Absorption, ASTM D 570 | 0.04% |
| 4. Tensile Strength, ASTM D 638 | 4000psi |
| 5. Coefficient of thermal expansion, ASTM D 696, | 2 x 10 ⁻⁵ in/in/F |
| 6. Flammability ASTM D-635 | Self-Extinguishing |
| 7. Flame Spread/ NFPA 101 ASTM E-84 | Class A |
- C. Topcoat:
- | | |
|--|---|
| 1. VOC | 0 g/L |
| 2. 60 Degree Gloss ASTM D523 | 75+/-5 |
| 3. Mixed Viscosity, (Brookfield 25°C) | 500 cps |
| 4. Tensile strength, ASTM D 638 | 7,000 psi |
| 5. Abrasion Resistance, ASTM D4060 | Gloss Satin |
| 6. CS 17 wheel (1,000 g load) 1,000 cycles | 4 - 8 mg loss with grit
10 -12 mg loss without
grit |
| 7. Pot life @ 70° F 50% RH | 2 hours |
| 8. Full Chemical resistance | 7 days |

2.5 PRODUCT MIXING

- A. Mix on site with manufacturer supplied mix and measure apparatus to ensure a timely, accurate mix ratio and minimize waste.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.

- B. Pre-installation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Masonry or concrete: 12 percent.
- C. Beginning Work of this Section means acceptance of existing substrate surfaces and site conditions.

3.2 PREPARATION - GENERAL

- A. General: Comply with requirements specified under Section 090560.02 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive flooring, and as additionally specified herein.
 - 1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
 - 2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
 - a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 20 lbs/1,000 sf/24 hrs.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 99% relative humidity level measurement.
 - c. If the vapor drive exceeds 99% relative humidity or 20 lbs/1,000 sf/24 hrs then the Owner and/or Engineer shall be notified and advised of additional cost for the possible installation of a vapor mitigation system that has been approved by the manufacturer or other means to lower the value to the acceptable limit.
 - 3. Mechanical surface preparation
 - a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
 - b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
 - c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
 - d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer's recommendations.

4. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.3 APPLICATION - GENERAL

A. General

1. The system shall be applied in five distinct steps as listed below:
 - a. Substrate preparation
 - b. Topping/overlay application with quartz aggregate broadcast.
 - c. Resin application with quartz aggregate broadcast.
 - d. Topcoat application
 - e. Second topcoat application.
2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.
3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer's recommendations.
4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.
5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Topping

1. The topping shall be applied as a self-leveling system as specified by the Architect. The topping shall be applied in one lift with a nominal thickness of 1/8 inch.
2. The topping shall be comprised of three components, a resin, hardener and filler as supplied by the Manufacturer.
3. The hardener shall be added to the resin and thoroughly dispersed by suitably approved mechanical means. SL Aggregate shall then be added to the catalyzed mixture and mixed in a manner to achieve a homogenous blend.
4. The topping shall be applied over horizontal surfaces using 1/2 inch "v" notched squeegee, trowels or other systems approved by the Manufacturer.
5. Immediately upon placing, the topping shall be degassed with a loop roller.
6. Quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.8 lbs/sf.
7. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

C. Broadcast

1. The broadcast coat resin shall be applied at the rate of 90 sf/gal (Q28) or 50 sf/gal (Q11).
2. The broadcast coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. Quartz aggregate shall be broadcast into the wet resin at the rate of 0.5 lbs/sf.

4. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Grout coat

1. The grout coat shall be squeegee applied with a coverage rate of 90 sf/gal (Q28) or 50 sf/gal (Q11).
2. The grout coat shall be comprised of liquid components, combined at a ratio of 2 parts resin to 1 part hardener by volume and shall be thoroughly blended by mechanical means such as a high speed paddle mixer.
3. The grout coat will be back rolled and cross rolled to provide a uniform texture and finish.

If an orange-peel texture is desired, sand screen the floor and apply a second grout coat of epoxy. The epoxy shall be applied by squeegee and back-roll with a coverage rate of 200 sf/gal (Q28) or 70 sf/gal (Q11).

E. Topcoat

1. The topcoat shall be roller applied with a coverage rate of 500 sf/gal.
2. The finished floor will have a nominal thickness of 1/4 inch.

3.4 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.5 PROTECTION AND TOUCH-UP

- A. General: Protect finished work under provisions of Section 090560.02 – COMMON WORK RESULTS FOR FLOORING.
- B. Clean up the work area at end of each work day. Remove all cartons, debris, emptied containers, as the work progresses, and finally at completion of work of this Section Legally dispose of same off the Site.
- C. During application of coatings, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- D. Protect all finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs therefor.
- E. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.
- F. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

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Section 09 68 00
CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. General: The work of this Section consists of carpeting where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, substrate testing and preparation, furnishing and installation of flooring, and temporary protection until Owner's acceptance.
- B. Prepare substrates to receive carpet as required to ensure specified tolerance level for finish surface of carpeting. Preparation work includes patching, smoothing and leveling subfloors and underlayment, including:
 - 1. Grinding down high spots of substrate.
 - 2. Providing Portland cement-based latex underlayment (filler).
- C. Furnish and install
 - 1. Carpeting directly adhered over floors at Auditorium, as indicated on Drawings, including all accessories necessary to complete the work.

1.2 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: substrate.
- D. Section 08 71 00 - DOOR HARDWARE: Furnishing metal thresholds.
- E. Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING: General requirements for flooring preparation, substrate testing requirements, installation and temporary protection, for flooring work provided under this Section 09 68 13.
- F. Section 09 65 13 - RESILIENT BASE AND ACCESSORIES: Straight resilient bases, where indicated in conjunction with carpeting.
- G. Division 26 - ELECTRICAL: In-floor electrical receptacles.

1.3 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM D 2859 - Test Method for Flammability of Finished Textile Floor Covering Materials.

2. ASTM D 418 - Methods of Testing Pile Yarn Floor Covering Construction.
3. ASTM D5116 - Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
4. ASTM E 84 - Surface Burning Characteristics of Building Materials.
5. ASTM E 648 - Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source.
6. ASTM E 662 - Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
7. CRI Indoor Air Quality Testing and Labeling Program.
8. NFPA: Publication 253 - Test for Critical Radiant Flux of Floor Covering Systems.
9. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Pre-installation Meetings: Installer of the Work of this Section is required to attend pre-installation conference specified under Section 09 05 60 - COMMON WORK RESULTS FOR FLOORING.
- C. Sequencing:
 1. Sequence work to ensure carpeting is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, wet work is dry and cured, and work overhead is completed.
 2. Ensure that installation of flooring and accessories occurs after other finishing operations and interior wet work is complete and fully cured, including painting.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including carpet, accessories, adhesives, and leveling materials.
 2. Manufacturer's installation instructions: Provide manufacturer's application methods or installation instructions for each item furnished hereunder. Indicate special procedures, and perimeter conditions requiring special attention.
 3. Manufacturer's sample warranties.
 4. Manufacturer's certificate: Provide certificate stating that the carpet, and other related materials to be supplied hereunder meet all requirements specified herein.

-
- a. Submit certification from the fiber producer verifying use of the branded fiber in the submitted carpet product.
 5. Indoor Air Quality Test Reports: Submit for specified products, indicating that the test results do not exceed the stated emission criteria of the CRI Indoor Air Quality Testing Program.
 6. Shop drawings: 1/8 inch scale plans of all carpeted areas indicating direction of carpet, location of seams and method of joining seams.
 - a. Show location of different patterns or styles of carpet.
 - b. Show locations of all threshold conditions.
 7. Selection samples:
 - a. Sample swatches containing manufacturer's full color and blend range.
 - b. Edge strip sample.
 8. Verification samples:
 - a. 12 inch long samples of edge strip.
 - b. After initial selection of carpet and color blends has been made by the Architect 18 inches by 27 inches sample of selected carpet for final approval of the Architect. Approved samples shall be used as the standard of quality and colors for materials furnished under this Contract.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Maintenance Data: Prior to final acceptance of the carpet installation, carpet subcontractor shall deliver to the Architect 3 printed copies of the carpet manufacturer's detailed maintenance recommendations for the care cleaning and stain-removal, and repair of the types of carpets installed. Include product data and Material Safety Data Sheets (MSDS) for cleaning materials.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Materials: Upon completion of the Work of this Section, Deliver to the Owner extra materials for future repairs and maintenance. Clearly label and package securely to prevent damage.
 - a. Owner's carpet stock: An amount equal to 3 percent of each color, pattern and type of carpet installed.
 2. Deliver specified overrun and usable pieces of carpet to owner's designated storage space, properly packaged and identified. Redirect small pieces of waste carpet to be appropriately recycled.
- 1.6 QUALITY ASSURANCE
- A. Manufacturer: Mill specializing in manufacturing specified with a minimum of three years documented experience.
 - B. Applicator: Company specializing in carpet installation of the type specified herein with a minimum of three years documented experience.

1.7 ENVIRONMENTAL CONDITIONS

- A. Do not install carpet until areas have been fully enclosed and environmental conditions have reached the levels indicated during occupancy.
- B. Store materials for 3 days (72 hours) prior to installation in area of installation to achieve temperature and humidity stability. Carpet and adhesive must be stored at a minimum temperature of 68 degrees F.
 - 1. Unroll carpet for a period of 72 hours prior to beginning of installation for adjustment to environmental conditions.
- C. Maintain area of installation at a temperature of at least 68 degrees Fahrenheit, with a relative humidity of between 15 and 65 percent, for a period of 72 hours before, during, and for 72 hours after installation.
 - 1. Ensure surface temperature of carpet substrate is great than 55 degrees Fahrenheit at commencement of carpet tile installation.
- D. Ventilate spaces where work of this Section occurs, during and for a period of 72 hours after completion of curing. Ventilate to dissipate humidity, and to prevent accumulation of fumes, vapors, and gases. Provide temporary fan units and ducting as required to for venting operations

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Carpet subcontractor is responsible for scheduling, receiving and placement on floors of goods from the manufacturer. Goods shall be delivered to the job site in the manufacturer's bundles and be clearly marked as to size, dye-lot and materials.
- B. Deliver carpet in sealed protective rolls and accessories in sealed containers. Bind carpet materials with secure protective wrapping. Mark each carpet roll according to style, color, pattern, dye lot, run number, and quantity.
- C. Waste Reduction: Collect polyethylene roll wrap at site and recycle into more roll wrap. Redirect small pieces of waste carpet to be appropriately recycled.
- D. Store all carpeting material under cover in dry, well-ventilated spaces as soon as delivered. Protect carpeting from damage, dirt, stain, moisture, and mildew.

1.9 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Carpet manufacturer's 10 year warranty which shall include texture retention, wear, and static protection and edge ravel resistance and run resistance strength for the life of the carpet. Commencing on the date of Project Substantial Completion.
 - 2. Carpeting installer's written guarantee covering prompt and proper replacement of any and all carpeting which indicates improper installation workmanship and/or defective material within twelve months from completion of the installation and acceptance thereof by the Architect, said corrective work being performed by the Carpeting installer at no cost to the Owner.

PART 2 - PRODUCTS

2.1 CARPET

- A. Carpet: To establish a standard of quality, design and function desired, specifications have been based on Shaw Industries, Dalton GA. Products of other manufacturers shall conform to the criteria specified herein below.
1. Manufacturers: Subject to compliance with the criteria specified herein, manufacturers offering products which may be considered the work include, the following, or approved equal:
 - a. Atlas Carpet Mills, Inc., City of Commerce, CA.
 - b. Beaulieu of America, Dalton GA.
 - c. Bentley Prince Street (Division of Interface Company), City of Industry, CA.
 - d. Blue Ridge Carpet Mills, Ellijay GA.
 - e. Collins and Aikman Floorcoverings, Dalton, GA.
 - f. Camelot Carpet Mills, Irvine, CA.
 - g. Constantine Carpet, Dalton CA.
 - h. Crossley Carpet Mills Limited, Truro, Nova Scotia, Canada.
 - i. Interface Americas, Inc., Atlanta, GA.
 - j. Invision Carpet Systems, Dalton GA.
 - k. J&J Commercial Carpet, Dalton GA.
 - l. Kraus Carpet Mills, Limited, Waterloo, Ontario, Canada.
 - m. Lees Carpet Company, (Division of Mohawk Group) Glasgow, VA.
 - n. Mannington Carpets Inc., Calhoun, GA.
 - o. Masland Carpets, Atmore, AL.
 - p. Milliken and Company, LaGrange, GA.
 - q. Mohawk Industries, Atlanta GA.
 - r. Monterey Carpets, Dalton GA.
 - s. PacifiCrest Mills, Inc., Irvine, GA.
 - t. Shaw Industries, Dalton GA.
- B. General requirements: Carpet, shall conform with or pass tests of the following Standards:
1. CRI – Green Label Plus.
 2. Traffic Level Classification (CRI Test Method 101): Heavy Traffic Use, (ASTM D-5252, 12,000 cycle Hexapod exposure conditioning test with result of greater than 3.0 ARR)
 3. ASTM D-2859 (Methenamine Reagent Pill Test).
 4. ASTM E-648 (Flooring Radiant Panel Test): Class I (Minimum Average CRF of 0.48).
 5. NBS Smoke Chamber Test: Maximum average of 450.
 6. AATCC-134 (Electrostatic Propensity): Maximum electrostatic generation below level of human sensitivity.

2.2 ACCESSORIES

- A. Filler for patching, smoothing and leveling flooring substrate: Refer to Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Adhesives for carpeting: NFPA Class A or UBC Class 1 types, as determined by ASTM E-84 Tunnel Test, as recommended by Carpet manufacturer for application and intended use.
 - 1. General:
 - a. Provide low VOC adhesives that comply with the following limits for VOC content:
 - 1) Indoor carpet adhesive: 50 g/L.
 - 2) Carpet pad adhesive: 50 g/L.
 - b. Multi-Purpose Adhesive for carpet: Low VOC permanent carpet adhesive as recommended by carpet manufacturer for direct glue down of carpet; comply with CRI Green Label Plus Certification Program. Use slow-set permanent adhesive for patterned carpet to facilitate pattern match.
 - c. Multi-Purpose Adhesive at steps: Low VOC permanent carpet adhesive as recommended by carpet manufacturer for direct glue down of carpet on steps; comply with CRI Green Label Plus Certification Program.
 - 2. Acceptable manufacturers are limited to the following listed manufacturers, having products that are CRI Green Label Plus Certified:
 - a. Advanced Adhesive Technology, Inc, Dalton GA.
 - b. DAP Incorporated, Dayton OH.
 - c. W.W. Henry Company, Aliquippa, PA.
 - d. W.F. Taylor Company, Inc., Fontana CA.
 - e. Roberts Consolidated Industries, Inc., Henderson NV.
 - f. Shaw Industries, Inc., Dalton GA
- C. Transition strips, carpet reducers, edgings and accessories: Composition nitrile rubber alloy, in colors as selected by the Architect.
 - 1. Acceptable manufacturers:
 - a. American Billtrite (Canada) Ltd., Sherbrooke, Quebec.
 - b. Burke Industries, San Jose, CA.
 - c. Roppe Corporation, Fostoria OH.
 - d. Freudenberg Building Systems Inc., Lawrence MA.
 - 2. Profiles as indicated, submit shop drawings for all conditions not indicated and obtain Architect's approval for each transition/reducer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.

1. Ensure that newly placed concrete has cured for a minimum period of 30 days and that moisture content of concrete is within range specified by adhesive manufacturer.
 2. Verify that surfaces are smooth and flat with a maximum variation of 1/4 inch in 10 feet, and are ready to receive work.
 3. Verify that surfaces are smooth and flat with a maximum variation of 1/8 inch in 10 feet, and are ready to receive work.
 4. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected
 5. Beginning of installation means acceptance of existing substrate and site conditions.
- B. Preinstallation Testing, Evaluation and Assessment: Moisture testing of concrete substrate, refer to Specification Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.

3.2 PREPARATION

- A. General: Comply with requirements specified under Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING, the flooring manufacturer's requirements for preparation of substrate to receive resilient flooring, and as additionally specified herein.
- B. Preheat areas to receive carpet to a minimum temperature of 60 degrees F for 72 hours prior to installation, with a relative humidity between 15 and 60 percent. Maintain minimum temperature of 60 degrees F thereafter.
- C. Measure all areas to receive materials to be furnished and installed hereunder, and verify in the field their actual dimensions, including wall-to-wall dimensions, offsets, door locations, and details, fixed equipment, and all other installed items. Extra charges will not be allowed because of lack of familiarity with actual project conditions. Use largest carpet widths to produce minimum number of seams. Small pieces of carpet will not be acceptable.
- D. Unroll carpet for adjustment to environmental conditions at least 24 hours prior to installation.

3.3 INSTALLATION – CARPET

- A. Install carpet in accordance with carpet and environmentally approved carpet adhesive manufacturers' instructions. Immediately notify Architect of conflicts.
- B. Layout carpet with location of seams per approved shop drawings.
- C. Cement carpet directly to the substrate with specified installation adhesive. Trowel adhesive evenly on the substrate. Install the carpet within thirty minutes after spreading adhesive.
1. Apply a 6 inch wide band of specified seaming adhesive continuously at each seam location, before bedding the carpet therein, ensuring that each carpet edge will be embedded therein at least 3 inches.

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2. Apply a continuous band of specified edge adhesive around entire perimeter edge of each carpeted area, and embed the carpeting therein.
 - D. Roll all carpet areas with a 30 pound carpet roller to ensure proper contact of carpet with adhesive, and to remove all bubbles and buckles. Carefully roll seams and edges with the roller centered over the seam.
 - E. Run all carpet in the same direction. Plan and install carpet in all areas so that single pieces per area shall be used to the fullest extent possible. No seams will be permitted in areas which are 12 feet, or less, in width.
 - F. Carefully measure all cut-outs at the project.
 - G. Make all seams in carpeting by back-cutting the carpet on an angle so that the face yarn of abutting pieces intermingles, and provides a practically invisible transition at each seam location.
 1. Center seams, occurring at door openings, parallel to, and directly under, the doors.
 2. Seams occurring at corridor changes in direction shall follow wall line parallel to carpet direction.
 3. Do not center seams in travel path to doors.
 - H. Do not center seams in path, perpendicular to, in the path of, or travel to doors.
 - I. Install specified edging wherever carpeting abuts a dissimilar flooring material, except where wood thresholds, or resilient floor tile trim occurs.

3.4 CLEANING

- A. Daily clean work areas by disposing of carpet scraps.
- B. After completion of the work of this Section:
 1. Remove equipment, and clean all wall, partition, and floor areas free from deposits of adhesives and other materials installed under this Section.
 2. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 3. Remove yarns that protrude from carpet surface.
 4. Clean and vacuum carpet surfaces.

3.5 PROTECTION

- A. General: Protect finished work under provisions of Section 09 05 60 – COMMON WORK RESULTS FOR FLOORING.
- B. Prohibit traffic from carpet areas for 24 hours after installation.
- C. Protect carpet against damage during construction. Cover with not less than 6-mil thick polyethylene covering with taped joints during construction period whenever protection is required, so that carpet will be without any indication of deterioration, wear, or damage at time of completion.
- D. Maintain protection of carpeting on each floor or area until work is accepted.

End of Section

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Section 09 72 33
DRY-ERASE WALL COVERING

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of dry-erase wall coverings where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following scope.
- B. Furnish and install the following:
 - 1. Dry-erase surface.
 - 2. Accessories.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 09 29 00 – GYPSUM BOARD: Prepared substrate to receive work of this Section.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM - E84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 2. GA 214 - Recommended Specifications for Levels of Gypsum Board Finish.
 - 3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Product Data: Manufacturer's product data and installation instructions for each type of wallcovering materials, adhesive, and accessories required.
 2. Shop Drawings: Plans and elevation drawings indicating locations and extent of wallcovering surfaces.
 3. Verification Samples:
 - a. 7 by 9 inch samples of dry erase material.
 - b. 6 inch samples of trim, tray, and end caps required.
 4. Manufacturer's Instructions: Manufacturer's written installation instructions.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Operation and Maintenance Data: Manufacturer's written instructions for recommended maintenance of dry erase wallcoverings.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 1. Drymarker and cleaning kits: Provide one kit for each room where dry-erase boards are located. As minimum, Kits to include, one dry-marker eraser, 3 colored dry-erase markers, 1 black dry-erase marker and one bottle of cleaner.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single manufacturer, or from manufacturers recommended by the prime manufacturer of wallcoverings specified under this Section.
- C. Qualifications:
 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful installations of wallcoverings of type required by this Section.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.

2. Do not deliver wallcovering materials to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
 3. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- C. Packaging Waste Management: Comply with disposal and recycling requirements specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
- 1.9 SITE CONDITIONS
- A. Maintain controlled relative humidity of less than 40 percent, with ambient and substrate temperatures above 55 degrees Fahrenheit (13° C) for 72 hours before, during and for 72 hours after installation. Do not apply wallcoverings when environmental humidity and temperatures are outside the ranges required by the wallcovering manufacturer.
- B. Provide not less than 80-foot-candles per square foot lighting level measured mid-height at substrate surfaces.
- 1.10 WARRANTY
- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. Manufacturer Warranty: Furnish manufacturer's limited 5 year warranty against manufacturing defects.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Koroseal Interior Products, Fairlawn, OH.
 2. OptiMA, Inc., Shrewsbury, MA.
 3. Smarter Surfaces, Dublin, Ireland.

2.3 MAGNETIC/PROJECTABLE DRY ERASE WRITING SURFACE

- A. Basis of Design: Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Koroseal Interior Products, Fairlawn, OH, "Walltalkers" series, product: "Projectable Mag-rite", model "M2PR," of sizes indicated on Drawings.
1. Description: Dry erase writing surface, having scrim backing, impregnated with ferrous powder, pigmented vinyl capped with dry erase film.
 2. Characteristics:
 - a. Conforming to ASTM E-84, Class A Flammability Testing.
 - b. Roll width: 47/48 inches (1.19/1.22m) width.
 - c. Fabric: Woven Polyester
 - d. Laminate thickness: 24 mils.
 - e. Tensile strength, (warp x fill): 80 by 80 pounds.
 - f. Surface: Matte finish.
 - g. Colors: As selected by the Architect from manufacturer's full range of options.
 3. Surface Burning Characteristics Classification: Provide materials that meet Class I/A rating when tested in accordance with ASTM E84 for flame spread and smoke developed.

2.4 ACCESSORIES

- A. Trim:
1. Cap Wallcovering Trim: Clear satin, anodized aluminum, low profile trim.
 2. Edge trim: Schlüter Systems L.P., product series "Schiene-E", in height as required for tile thickness, roll-formed from type 304 stainless steel with a perforated anchoring leg, or approved equal.
 - a. Edging materials: Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1) Schlüter Systems L.P., Plattsburgh NY.
 - 2) Custom Building Products, Inc., Seal Beach, CA.
 - 3) Ceramic Tool Company Inc., Waukesha WI.
- B. Adhesives: Solvent-free, SBR type linoleum adhesive (L-910) or polyvinyl acetate dispersion type (contact adhesive) when used in a press.
- C. Substrate primer/sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per GA-214: Recommended Levels of Gypsum Board Finish, and permanent lighting should be installed and operational.

- B. Test substrate with a suitable moisture meter and verify that moisture content does not exceed four percent.
- C. Verify substrate surface is clean, dry, smooth, structurally sound, and free from surface defects and imperfections that would show through the finished surface.
- D. Evaluate all painted surfaces for the possibility of pigment bleed-through.
- E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
- F. Beginning of installation means acceptance of surface conditions.

3.2 INSTALLATION

- A. Acclimate wallcovering in the area of installation a minimum of twenty-four hours before installation.
- B. Examine all materials for color, quantity, and quality as specified for the correct location prior to cutting.
- C. Comply with manufacturer's printed installation instructions.
- D. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least twenty-four hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.
- E. Permanent HVAC system should be set to 68 degrees Fahrenheit (20 degrees Celsius) for at least seventy-two hours prior to, during, and after the installation.
- F. Back roll each sheet prior to the installation to release curl memory.
- G. For seamed applications, using a seam and strip cutter remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat this step for as many sheets as required for the job.
- H. Scribe, cut, and fit material to butt tightly to adjacent surfaces, built-in casework, and permanent fixtures and pipes.
- I. Apply adhesive with a 1/16 inch square notch trowel to the area to receiving the sheet (apply enough for one sheet at a time).
- J. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.
- K. Remove adhesive residue immediately after each panel is hung, wash with a mild soap/water solution and a soft cloth/sponge.

3.3 CLEAN-UP

- A. Upon completion of installation, remove all exposed adhesive immediately using a soft cloth and a warm, mild soap solution and rinse thoroughly with water and dry with clean towel prior to using.

- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.4 PROTECTION

- A. Protect installed product and finish surfaces from damage during construction.

End of Section

Section 09 77 23
ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Back mounted fabric wrapped acoustical wall panels with impact-resistant face.
 - 2. Back mounted vinyl wrapped wrapped acoustical wall panels with impact-resistant face.
 - 3. Pre-finished aluminum angle trim at exposed edges of acoustical wall panels.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Concealed wood blocking and nailers.
- D. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Non-load bearing partition framing and furring.
- E. Section 09 81 00 - ACOUSTICAL INSULATION: Acoustical batt insulation between wall framing

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method.
 - 2. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

3. ASTM E699 - Practice for Criteria for Evaluation of Agencies Involved in Testing Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6.
4. NFPA 701 - Vertical Burn Test.
5. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.
2. Do not deliver acoustical panels to the project until substrate surfaces are complete and finished, and all concrete, masonry, plaster, and other wet work has been completed and dry.

C. Scheduling:

1. Coordinate schedule of installation so that acoustic panels are not delivered to site until all wet work has completed .

1.6 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets, specifications, and acoustical performance data.
 - a. Note on submittals any deviations from specified requirements and the reasons thereof.
 - b. Furnish information on manufacturer's full range of standard colors, textures, and patterns available for selection.
2. Material certificates: Provide for the following, signed by panel fabricator and Contractor certifying that upholstered system complies with the specified flame spread and acoustical requirements.
3. Panel fabricator's field installation/setting instructions.
4. Maintenance information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
5. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

6. Shop drawings:
 - a. Dimensioned 1/4 inch scale elevations, bearing dimensions of actual measurements taken at the project, where practical. indicate on elevations, arrangement of joints, and panel identification numbers for ease of installation.
 - b. Large scale design details showing attachment method; edge and joint conditions.
 7. Selection samples:
 - a. Fabric line card: Furnish information on manufacturer's full range of standard colors, textures, and patterns available for selection.
 - b. Furnish 3 by 9 inch square samples of fabrics, of requested fabrics.
 8. Verification samples: 24 by 24 inch samples of completed fabric panel assembly mounted to a hardboard substrate using specified mounting system. Sample shall illustrate selected edging profiles, facing fabric and mounting system
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Bonds and Warranty Documentation: Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Acoustical Wall Panels: Furnish quantity of full size units equal to 3 percent of the amount installed.
- 1.7 QUALITY ASSURANCE
- A. General: Notify the Architect where conflicts apply between referenced standards, existing materials, and existing methods of construction.
- B. Sole Source: Obtain each type of acoustical wall panel from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying the progress of the Work.
- 1.8 DELIVERY, STORAGE AND HANDLING
- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Do not deliver fabric panel materials to the project building is enclosed and temperature and humidity can be controlled to within limits specified herein.
 3. Do not deliver fabric panel materials to the project until all concrete, masonry, plaster and similar wet work has been completed and dry.
 4. Deliver materials in original unopened packages, containers or bundles bearing brand name, and identification of manufacturer, with labels and package seals intact and legible.

5. Damaged material: Remove any damaged or contaminated materials from job site immediately, including materials in broken packages, packages containing water marks, or show other evidence of damage, unless Architect specifically authorizes correction thereof and usage on project.
 6. Deliver prefabricated panels to site with concealed panel identification numbers corresponding to identical numbers on shop drawings. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.
- B. Storage and Handling Requirements:
1. Store and handle materials following manufacturer's recommended procedures, and in accordance with material safety data sheets.
 2. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- 1.9 PROJECT CONDITIONS
- A. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of upholstered wall system, and maintain until Owner's Final Acceptance.
- 1.10 FIELD MEASUREMENTS
- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.
1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabrication of acoustical wall panels without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to guaranteed dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Decoustics, Etobicok, Ontario Canada.
 2. AVL Systems Inc., Ocala FL.
 3. Conwed Designscape | Wall Technology (Division of Owens Corning), Granville, OH.
 4. Corporate Acoustic Systems, Poughkeepsie NY.
 5. ESSI Acoustical Products Company, Cleveland OH.
 6. Armstrong World Industries, Lancaster, PA.

2.2 PERFORMANCE CRITERIA

- A. Fire performance characteristics: Fabric panel assembly tested in accordance with ASTM E 84 with gypsum wall board substrate, is UL rated Class A, with the following results.
 - 1. Flame Spread: 25 or less.
 - 2. Smoke Developed: 450 or less.
- B. Sound Absorption Performance: Provide acoustical wall panels with minimum noise reduction coefficients (NRC) indicated as determined by testing per ASTM C423 for mounting type specified under individual product requirements.
 - 1. NRC for 1 inch panels: 0.80, minimum.

2.3 ACOUSTICAL PANELS

- A. General: Back-Mounted, Edge-Reinforced Acoustical Wall Panels.
 - 1. Panel Sizes: As indicated.
 - 2. Edge Detail: Square.
 - 3. Corner Detail: Square.
- B. Type 1 panel: Fabric Facing
 - 1. General: All fabric shall be in compliance with local and State fire regulations. Flame resistant treatment shall be applied to back of fabric only.
 - 2. Fabric: Guilford of Maine, Wellington Contract Fabrics, or Architect approved equal.
 - a. Content: 100 per cent Olefin.
 - b. Minimum weight: 17 ounces per linear foot.
 - c. Width: 54 inches.
 - d. Color and pattern: As selected by the Architect.
- C. Type 2 panel: Perforated Vinyl Facing
 - 1. General: All fabric shall be in compliance with local and State fire regulations. Flame resistant treatment shall be applied to back of fabric only.
 - 2. Fabric: Self-healing, mildew resistant perforated vinyl embossed fabric
 - a. Color and pattern: As selected by the Architect.
- D. Acoustic cores: Rigid fiberglass core board with woven fiberglass scrim face and chemically hardened edges.
 - 1. Core Density: 6 - 7 pounds per cubic foot.
 - 2. Thickness: 1 inch.
- E. Mechanical Mounting system: Concealed Z-clips and wall mounting clips, recessed into panel to allow back of panel to lie flush with wall surface.
 - 1. Self aligning, 20 gage hot-dipped galvanized steel.
 - 2. Leveling clip angle: 20 gage hot-dipped galvanized steel angle.

2.4 ACCESSORIES

- A. Aluminum trim at exposed edges of acoustical wall panels: 1.25 by 2 inch extruded aluminum angle, having minimum wall thickness of 0.125 inches, factory/shop finished with white color enamel.

2.5 FABRICATION

- A. Fabricate panels to sizes and configurations indicated, fabricate square and true to size; machine corners to exact size.
 - 1. Maximum variation from indicated panel length or width: Plus or minus 1/16 inch.
 - 2. Maximum variation from specified panel thickness: Plus or minus 1/32 inch.
- B. Rabbet panels to receive concealed mounting device.
- C. Attach facing materials to cores to produce installed panels with visible surfaces fully covered and free from wrinkles, sags, blisters, seams, adhesive or other foreign matter.
 - 1. Stretch backing material tautly into place, tension to balance frame, and stapled to the back of frame. Install specified infill materials tight to frame, without gaps.
 - 2. Wrap specified facing material around panel, return a minimum of 2 inches facing material on backside. Fabricate corners without pleats or cuts.
 - 3. Stretch fabric facing tautly into place, baste and cure. Mechanically restretch and baste fabric under tension to panel framing to assure that the fabric grain is square after the restretching has been completed.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all substrate surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify plaster surface is within manufacturer's specified tolerances and has been primed.
- C. Notify Architect in writing when project conditions are unacceptable to fabric system Installation. Beginning of installation means acceptance of substrate and project conditions.

3.2 INSTALLATION - MECHANICAL CLIPS

- A. Perform installation in accordance with manufacturers written instructions for the installation method specified. Obtain Architect's written direction if field conditions prohibit installation using specified fastening system.
- B. Locate and install appropriate wall fasteners on receiving substrate surface.
- C. Install acoustical wall panels in exact position corresponding with panel identification number on approved shop drawings.

- D. Install panels with vertical surfaces and edges plumb, top edges level, and in alignment with other panels. Butt joint panels without gaps.

3.3 TOLERANCES

- A. Maximum variation of panels from true location: Plus or minus 1/8 inch.
- B. Maximum variation of surfaces intended to be flush: plus or minus 1/32 inch.

3.4 CLEANING AND ADJUSTING

- A. Adjust panels dislodged from indicated position, plumb and level.
- B. Upon completion of the work of this Section, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Clean surfaces of upholstered panels free from dirt and handling marks using methods and materials recommended by panel system manufacturer. All upholstered surfaces which cannot be cleaned, or which are otherwise damaged shall be removed and replaced with new work in conformance with the Contract Documents.

3.5 PROTECTION

- A. Protect panels from soiling or other damage, until Final Acceptance of Contract by Owner.

End of Section

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Section 09 77 33
SANITARY WALL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. USDA approved and FM Global approved glass fiber reinforced plastic panels.
 - 2. Installation adhesive, non-corroding fasteners, vinyl moldings, and all other components.
 - 3. Silicone sealant for all joints between panels and moldings, and between panel system and abutting materials.
- B. Install access panels occurring in plastic panels furnished by Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: blocking.
- D. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Hollow metal door frames to receive ends of panel system.
- E. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate:
- F. Section 08 31 00 - ACCESS DOORS AND PANELS, and by trades requiring the same: Shop primed access panels, occurring in partitions and walls.
- G. Division 21 - FIRE SUPPRESSION: Fire suppression system.
- H. Division 26 - ELECTRICAL: Recessed electrical receptacles.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
1. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
 2. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
 3. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
 4. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 5. ASTM D 2583 - Barcol Hardness.
 6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 8. FM Global Property Loss Prevention Data sheet 1-57 – Plastics in Construction.
 9. All applicable federal, state and municipal codes, laws and regulations regarding wall finishes and smoke generation.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 - a. Provide FM Global product approval.
 2. Certification: Manufacturer's written certification stating that panel system and all related components to be furnished hereunder, meet or exceed the requirements specified under this Section that all fire-resistive requirements for the indicated requirements have been met.
 3. Shop drawings: 1/4 inch scale elevations showing panel joint locations.
 4. Selection samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect.
 5. Verification samples:
 - a. 12 x 12 inch samples of panel illustrating material and finish.
 6. LEED Submittal Requirements:
 - a. Submit completed LEEDv4 Materials Reporting for applicable material requirements as required in Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.
 - b. The work of this Section includes responding to Architect or Contractor requests for additional information or product data and may be required

following initial Green Building Certification Institute (GBCI) review of LEED Application.

- c. Product substitution requests are subject to additional LEED submittal requirements including, but not limited to, Environmental Product Declarations (EPD), Health Product Declarations (HPD), and General Emissions Testing. See Section 01 25 13 – PRODUCT SUBSTITUTION PROCEDURES.
- d. Include submittal documentation requirements for IEQ Credit 2 Low Emitting Materials, On-Site Wet-Applied Products (paints, coatings, sealants and adhesives), to provide both CDPH Standard Method v1.1 – 2010 emissions compliance and VOC compliance in accordance with SCAQMD Rule 1113 – June 3, 2011 (paints and coatings), and/or SCQMD Rule 1168 – July 1, 2005 (adhesives and sealants). Products tested/certified under the following programs will meet the emissions requirement: FloorScore; SCS Indoor Advantage Gold; UL Greenguard Gold.
- e. Include submittal documentation requirements for IEQ Credit 2 Low Emitting Materials, Ceiling and Wall Systems (gypsum board products, insulation, acoustical ceiling systems and wall coverings) to provide CDPH Standard Method v1.1 – 2010 emissions compliance. Products tested/certified under the following programs will meet the emissions requirement: SCS Indoor Advantage Gold; UL Greenguard Gold.
- f. Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for recycled content.
- g. Include submittal documentation requirements for MR Credit 3 Building Product Disclosure and Optimization – Sourcing of Raw Materials for certified wood.
- h. Include submittal documentation requirements for MR Credit 2 Building Product Disclosure and Optimization – Environmental Product Declaration for EPDs.

1.6 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Qualifications:
 - 1. Installer specializing in applying the work of this Section with a minimum of 3 years experience and approved by product manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver panels to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Remove panels from shipping cartons/skids. Stack panels on a solid flat, dry surface. Do not stack panels direct on concrete flooring or any other surface that emits moisture. Lay Panels flat; do not stand panels on edge, do not store products near a heat source.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Crane Composites, Joliet IL.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following
 1. Crane Composites, Joliet IL., (Glasbord and Kemlite Products).
 2. Marlite Inc., Dover OH (Marlite FRP products).
 3. Nudo Products, Inc., Springfield, IL. (Fiber-Lite Products).

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 MATERIALS

- A. Panels: Fiberglass reinforced plastic panels, ASTM E-84 Class A Fire Retardant Rated, having smooth finish.
 1. Panel Thickness: 0.09 inch (2.3mm) thickness.
 2. Performance Requirements:
 - a. Flexural Strength (ASTM D 790): 13.6×10^3 psi (94Mpa).
 - b. Flexural Modulus (ASTM D 790): 0.60×10^6 psi (4137 MPa).
 - c. Tensile Strength (ASTM D 638): 7.1×10^3 psi (49 MPa).
 - d. Tensile Modulus (ASTM D 638): 0.92×10^6 psi (6343 Mpa).
 - e. Hardness (ASTM D 2583): Barcol Hardness 40.
 - f. Impact Strength ASTM D 256): 12.0 ft-lb/in notched (0.64 J/mm).
 - g. Taber Abrasion Resistance (Taber Test, CS-17 wheel, 1000 gram weight, 25 cycles): 0.02% maximum weight loss.
 3. Panel Color: as selected by Architect from Manufacturer's standard colors
 4. Acceptable products include the following:
 - a. Crane Composites, Kemlite product: "Glassbord with Surfaseal".
 - b. Marlite product: "Marlite Standard FRP" panels (Class 1/A).
 - c. Nudo products: Inc., "Fiber-Lite LP-F9-FR wall panels." (Class A).

2.4 ACCESSORIES

- A. Aluminum trim: Heavy weight extruded aluminum 6063-T5 alloy prefinished at the factory.
 - 1. Aluminum Finish: Factory thermo-set enamel or powder coat finish.
- B. Fasteners: stainless steel or nylon fasteners as recommended by the panel manufacturer for the application indicated in the Drawings.
- C. Adhesive: Multi-purpose non-flammable, non-staining, construction adhesive: Kemlite No. 260, Henry No. 444, or equal.
- D. Sealant: One part acetoxo silicone rubber sealant, USDA approved as recommended by panel manufacturer.
- E. Moldings: One piece extruded vinyl moldings, color matched with panels, for application between abutting panels, inside and outside corners, and panel edges as recommended by the panel manufacturer and where indicated in the Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for work of this Section. Inspect all gypsum wall and plywood substrates and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Surfaces receiving work of this Section must be absolutely dry, free from dirt, dust, grease and other foreign materials that will prevent proper adhesion of the wall panels.
- B. Verify gypsum board substrate surfaces are flat, conforming to Gypsum Association specifications for a Level 3 finish.
- C. Plywood substrate surfaces should be flat to within 1/8" in 10 feet, Sand smooth high spots, and fill low spots with wood filler approved by panel manufacturer.

3.3 INSTALLATION, GENERAL

- A. Install work in strict accordance with the manufacturer's written instructions.
- B. Set and secure materials in place, plumb and level. Maintain 1/4" gap at ceiling and junction with flooring base. Maintain 1/8 inch gap between panels and division bar molding to allow for normal expansion and contraction. Allow 3/16 inch around pipes, electrical fitting and other projections.

3.4 APPLICATION OF PANELS WITH MECHANICAL FASTENERS

- A. Install with non-corroding fasteners with as recommended by the panel manufacturer for the substrate. Pre-drill panels for fasteners with holes over-sized by 1/8 inch.
- B. Locate fasteners in patterns as indicated on the Drawings.
- C. Install fasteners no further than 8 inches apart along top and bottom edges and 16 inches apart on intermediate fasteners. Stagger fasteners on opposing panel edges and corners next to division bar for tight flat seam.
- D. Drive fasteners to snug fit, do not overtighten

3.5 APPLICATION OF PANELS WITH ADHESIVE

- A. Ensure that both panels and substrate are free of moisture, dirt, dust and other contaminants which may affect the bond of adhesive.
- B. Apply adhesive when temperature is between 50 and 90 degrees F.
- C. Trowel adhesive evenly on back of sheets, 1/4 deep with square notch trowel, or apply with cartridge gun spacing beads not more than 8 inches in center of panel and run a single bead along all edges of panel.
- D. Set panels in position and press against wall. Pull panel away from wall to flash off solvents. Press panel against wall again, apply adequate pressure to make full contact between panel and wall. Brace panel along vertical edges until adhesive is cured.
- E. Apply mechanical fasteners along top and bottom edges as specified in Article 3.04 above.

3.6 APPLICATION OF SEALANT AND MOLDINGS

- A. Install sealant and moldings, in sequence as recommended by the panel manufacturer to achieve a moisture resistant application of the panel system.
- B. After installation of panels and moldings has been completed, apply a continuous bead of specified sealant to all joints between the work of this Section and abutting surfaces. Tool the sealant to a uniformly dense surface, level with the edges of moldings. Immediately remove all excess sealant from finished surfaces.
 - 1. Install joint bead back-up in joints with abutting materials where joints are in excess of 5/8-inch depth, and joints that have no back-up therein, placing the joint bead in the joint in a manner that will assure a constant depth 1/8 inch greater than the sealant and caulking material depth tolerances.
 - a. Set beads into joints continuously, by slightly stretching during placement, to permit compression against sides of joint, without surface wrinkles or buckles.
 - 2. Apply sealant into joints in accordance with sealant manufacturer's instructions, using mechanical or power caulking gun equipped with nozzle of appropriate size, with sufficient pressure to completely fill the joints.

- a. The depth of sealant shall be in accordance with manufacturer's recommendations for the specific joint function, but in no case exceed 1/2-inch in depth, nor less than 1/4-inch, regardless of the joint width.
- b. Maintain the outer edge of the sealant, where side faces of joints are in the same plane, back 1/8-inch from the faces.
- c. After placement of the sealant in joints with abutting materials, concave-tool the surfaces to uniform density, using a water-wet tool. Do not use detergents or soapy water for the tooling operations.
- d. Remove the temporary masking tape immediately after tooling, and before the sealant or caulking material has taken initial set.

3.7 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris and scraps.
- B. Completely clean all panel surfaces, clean all surfaces of adjacent surfaces which have been marked or soiled by the work of this Section, removing all excess sealants and adhesives with solvents which will not damage the surfaces in any way.
- C. Upon completion of the work of this Section, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.8 PROTECTION

- A. During the operation of sealant work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled.

End of Section

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Section 09 81 00
ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of acoustical insulation where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following.
- B. Furnish and install:
 - 1. Acoustical insulation as scheduled and where indicated.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood framing, blocking, nailers.
- D. Section 07 21 00 - THERMAL INSULATION.
- E. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING.
- F. Section 09 29 00 - GYPSUM BOARD: Installation of wall board over acoustical insulation.
- G. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Ductwork and piping insulation.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 518 - Thermal Transmission Properties by Means of the Heat Flow Meter.

2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
3. ASTM E 96 - Water Vapor Transmission of Materials.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Certificates:
 - a. Provide manufacturer's written certification of recycled glass content in glass fiber acoustical insulation.
 - b. Provide manufacturer's written certification of recycled slag content in mineral wool insulation.
 3. Sustainable Design Submittals: Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources.
 - a. Include statement indicating costs for each product having recycled content.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Deliver materials in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.
 2. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Storage and Handling Requirements:
1. Store materials under cover and in manner to keep them dry, protected from weather, direct sunlight and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products include the following:
1. CertainTeed Corporation, Valley Forge PA.
 2. Johns Manville Building Insulation, Denver, CO
 3. Owens Corning Fiberglas Corp., Toledo OH.
 4. (Goldline brand) Schuller International, Inc., Denver CO.
 5. USG Corp./ USG Interiors Inc., Chicago IL.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 MATERIALS

- A. Acoustical batt insulation: Unfaced glass fiber insulation nominal 3-1/2 inches [89mm] thick conforming to ASTM C-665 Type I, of width appropriate for spacing of framing or furring members with which used.
 - 1. Flame Spread Classification: Class A (less than 25, per testing by NFPA 255, ASTM E-84 or UL 723).
 - 2. Recycled content of glass in glass-fiber insulation: Use maximum available percentage of recycled glass. Fiber glass insulation products incorporated into the work shall contain not less than 20 percent of recycled glass cullet.

2.4 ACCESSORIES

- A. Staples, tape, adhesives and fasteners required for the proper and complete installation for work of this Section shall be as recommended by each respective manufacturers of each insulation type.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install insulation in accordance with insulation manufacturer's instructions.
- B. Install in interior walls, and ceiling spaces where indicated. Trim insulation neatly to fit spaces. Fit insulation tight in spaces. Leave no gaps or voids.

3.2 CLEANING

- A. Daily clean work areas by sweeping and disposing of debris and scraps.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

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Section 09 84 15
WOOD FIBER ACOUSTICAL PANELS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Interior acoustical wall panels.
 - 2. Pre-finished aluminum angle trim at exposed edges of acoustical wall panels.
 - 3. Sealant and backing materials, for joints between panels and abutting surfaces.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood furring and blocking.
- D. Section 07 92 00 - JOINT SEALANTS: Sealants, other than those specified herein.
- E. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Metal framing for drywall construction work, and attachment.
- F. Section 09 29 00 - GYPSUM BOARD: Drywall construction work having taped and compounded finish.
- G. Section 09 91 00 - PAINTING: Field applied primer (including backpriming) and finish coatings.

1.4 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, installation instructions for hardware, adhesives and accessories furnished hereunder.

2. Shop drawings: Large scale design details, showing spline attachment and edge fastening methods; and complete installation details.
3. Samples: Provide samples as requested by Architect for selection of colors and finishes.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver interior materials to the project until all concrete, masonry, plaster, and other wet work has been completed and dry.
- B. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location maintaining 60 degrees Fahrenheit and a maximum relative humidity of 55 percent.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

- A. Panels: Cellulose composition
 1. Tectum Inc., Newark OH., product "Finale Tectum wall panels".
 2. Martin Acoustical Products, Bogart GA, product "AcoustiPlank" acoustical wall panels.
 3. Or approved equal.
- B. Panel characteristics:
 1. Minimum 0.85 NRC.
 2. Thickness: 2 inches total thickness.
 - a. Panel thickness 1 inch.
 - b. Furring with insulation: 1 inch thickness.
 - c. Panel Edges: Manufacturer's beveled edge.
 3. Furring: 1 inch with integral mineral wool insert.
 4. Size: 23-3/4 inches width by maximum length practical to reduce number of end joints.
 5. Finish: Factory finished white.

2.2 ACCESSORIES AND HARDWARE

- A. Aluminum trim at exposed edges of acoustical panels: 2 by 2 inch extruded aluminum angle, having minimum wall thickness of 0.125 inches, factory/shop finished with white color enamel.
- B. Provide all fasteners (preservative treated furring strips) and OCF 703 fiberglass insulation.
- C. Screws: Flat-head wood screws of the appropriate sizes, galvanized finish for interior use and stainless steel for exterior use.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of blocking, backing and support framing for all finish carpentry work.
- B. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 INSTALLATION

- A. Conform to manufacturer's installation details, All fastening devices shall be concealed in completed installation.
- B. Secure wall panels by means of furring strips securely attached to wall, perpendicular to panel direction, at 24 inches on center. Support bottom edges of panels by continuous wood strip blocking or metal angle.
- C. Size panels to provide a minimum of splices and joints. Stagger joints in manufacturer's recommended "ashlar" pattern. Provide blocking at butted ends.
- D. Scribe and cut work to fit adjoining work closely. Refinish cut surfaces in prefinished items.
- E. Attach panels to furring with painted head drywall screws with screw spacing recommended by manufacturer, but not less than one per every 3 square feet of panel. Provide additional screws in gymnasiums and similar spaces of anticipated high impact.

3.3 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.

End of Section

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Section 09 91 00

PAINTING

(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.

1.2 SUMMARY

- A. Section Includes: This Section consists of painting work where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Painting work includes, but is not limited to the surface preparation and application of coated finishes, and subsequent touch-up, of interior and exterior items and surfaces as indicated on the Contract Drawings and as scheduled herein.
1. No attempt is made in this Section to list all surfaces, fixtures and equipment requiring painting on this project. It is the responsibility of the Subcontractor to determine for itself the scope and nature of the Work required for a complete installation from the information provided herein and in the Drawings.
- B. Surfaces and Materials: In general, without limiting the generality thereof, the following surfaces, fixtures and equipment require a painted finish:
1. Gypsum board partition and wall surfaces, ceilings and soffits.
 2. Metal doors and frames.
 3. Interior concrete masonry.
 4. Interior handrails and guardrails.
 5. Wood trim.
 - a. Bumper rails (Accent Colors) in Corridors and Classrooms.
 - 1) Refer to color schedule at end of Section.
 6. Roof top equipment.
 7. Exposed to view structural steel.
 8. Wood door tops and bottoms, cut in the field, or without factory finish.
 9. Wood fiber acoustical panels (includes field painting of acoustically-transparent final color coats over 'white' factory-finished panels).
 10. Plywood wall panels for HVAC, Fire Prevention, Electrical and telephone/data equipment.
 - a. Shop paint fire-retardant treated plywood panels, primed and painted on both sides prior to installation, coordinate with Section 06 10 00 – ROUGH CARPENTRY.
 11. Exposed to view sprinkler piping.

PAINTING

12. Exposed to view electrical conduit and raceways.
 13. Exposed to view, universal framing support system ("Unitstrut") factory-galvanized steel support system furnished under under Section 05 50 00 - METAL FABRICATIONS.
 14. Exposed to view, universal framing support system ("Unitstrut") factory-painted steel support system, to be repainted White; furnished under under Section 11 66 53 – GYMNASIUM DIVIDERS.
 15. Elevator ladder, exposed to view lintels and other miscellaneous metal items furnished under Section 05 50 00 - METAL FABRICATIONS which are not factory finished.
 16. Access panels and frames.
 17. Counter and bench supports.
 18. Interior steel mullions at glazing.
 19. Exterior speakers.
 20. Exterior hose bib covers.
 21. Paint surfaces behind arch grilles.
 22. Exterior surfaces of paint spray booth.
- C. DO NOT PAINT the following surfaces and materials.
1. Concealed from view surfaces, except as indicated otherwise in the Contract Documents or as specified herein.
 2. Chrome or nickel plating, stainless steel, bronze, brass.
 3. Aluminum other than mill finished or factory primed.
 4. Factory finished mechanical and electrical equipment, pumps, machinery and similar items which occur in mechanical, storage or equipment rooms or areas.
 5. Factory finished materials, specialties, and accessories unless otherwise specified.
 6. Ceramic tile, terrazzo, acoustical tile, resilient flooring, wood flooring, and other integrally finished floor, wall and ceiling finishes.
 7. Prefinished millwork items.
 8. Fire resistant testing and certification labels, code required labels, safety warning labels, performance rating plates, nomenclature plates, identification plates, and similar other labels.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete partitions and walls.

- D. Section 04 20 00 - UNIT MASONRY: Concrete masonry partitions.
- E. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Shop priming of structural steel framing.
- F. Section 05 50 00 - METAL FABRICATIONS: Shop priming of designated miscellaneous metals.
- G. Section 06 20 00 - FINISH CARPENTRY: Wood trim items, setting and filling of nails, sanding of wood trim.
- H. Section 07 92 00 - JOINT SEALANTS: Requirements for sealant and backing materials.
- I. Section 08 11 13 - HOLLOW METAL DOORS AND FRAMES: Shop priming of metal frames and steel doors.
- J. Section 08 14 16 - FLUSH WOOD DOORS: Wood doors, both prefinished and unfinished.
- K. Section 08 31 00 - ACCESS DOORS AND PANELS: Shop primed access panels, occurring in partitions and walls.
- L. Section 09 29 00 - GYPSUM BOARD: Drywall partitions, ceilings and soffits, including joint treatment and sanding.
- M. Document 09 91 13 - EXTERIOR PAINTING SCHEDULE: Painting schedule for exterior surfaces and materials:
- N. Document 09 91 23 - INTERIOR PAINTING SCHEDULE:
 - 1. Painting schedule for interior surfaces and materials.
 - 2. Painting schedule for Mechanical and Electrical Equipment.
- O. Section 10 40 00 - SAFETY SPECIALTIES: Shop priming of cabinet doors and frames; shop finishing of cabinet.
- P. Division 22 - PLUMBING: Prefinished items such as plumbing fixtures, sprinkler heads, convectors, anemostates and similar surfaces and materials.
- Q. Division 26 - ELECTRICAL: Prefinished items such as light fixtures, switch gear, electrical distribution cabinets and similar surfaces and materials.
- R. Respective sections: Factory-finishing of food service, mechanical, plumbing, fire protection and electrical equipment.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. ANSI/ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products.
2. ASTM D 2016 - Test Method for Moisture Content of Wood.
3. SSPC-Vis1 - Pictorial Surface Preparation Standards for Painting Steel Structures.
4. SSPC-SP2 - Steel Structures Painting Manual, Volume 2, Systems and Specifications.
5. All applicable federal, state and municipal codes, laws and regulations for flammability and smoke generation of interior finishes.

B. Definitions:

1. "Paint" includes coating systems materials, primers, emulsions, enamels, stains, sealers and fillers, and other applied materials specified herein, whether used as prime, intermediate or finish coats.
2. Gloss as defined for LEED VOC requirements. Specified specular gloss readings below are as tested in accordance with ASTM D52.
 - a. Flat: less than 15 (measured at 85 degrees), less than 5 (measured at 60 degrees).
 - b. Non-Flat: greater than 15 (measured at 85 degrees), greater than 5 (measured at 60 degrees).
3. Sheen: Specular gloss readings in accordance with ASTM D52.
 - a. Flat: less than 5 (measured at 85 degrees).
 - b. Eggshell: 5 – 20 (measured at 60 degrees).
 - c. Satin: 15-35 (measured at 60 degrees).
 - d. Low Luster: 25 – 35 (measured at 60 degrees).
 - e. Semi-Gloss: 30 -65 (measured at 60 degrees).
 - f. Gloss: 65 or more (measured at 60 degrees).

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: The applicator of work specified herein is responsible to ensure that all paints, enamels, and coatings, proposed to be applied hereunder, are compatible with coatings used for shop-primed items and items which have been prime-coated under the work of other trades.
2. Immediately notify the Architect in writing of conditions which may require a change in the specifications of this Section before proceeding with the work. Failure to do so, in a timely fashion, so as not to interfere with the schedule of work of this Contract, shall be construed as acceptance of the coatings specified. Perform all corrective measures, at no cost to the Owner, for any defects in the work, resulting from the use of such materials.

B. Scheduling: Painting work should be scheduled so as to minimize touch-ups. Interior painting is to be without flashmarks. Should flashmarks occur due to touch-ups, the Contractor shall be required to redo the entire surrounding wall surface.

C. Do not order materials until all required schedules have been properly submitted, reviewed by the Contractor and Approved by Architect.

1.6 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, material compositions, and application instructions for all finishing products to be applied hereunder.
 - a. Include certification of data indicating Volatile Organic Compound (VOC) content of all paint materials.
 - 2. Samples:
 - a. Manufacturer's color selector for custom mixed colors for Architect's color scheduling.
 - b. Opaque coatings: Two 9 x 12 inch finished samples on hardboard of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
 - c. Transparent finishes and stains: Two 9 x 12 inch finished samples on same species of solid wood and plywood to be furnished under Section 06 20 00 - FINISH CARPENTRY, of each color scheduled in each finish for review and approval. Identify boards with finish type, color mix number and scheduled substrate surfaces or materials.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Color chips: After final approval of all colors and tints by the Architect, submit to the Owner, color chips of all coatings used, with manufacturer's name and mix designation of the coating for the purpose of future re-ordering of coatings. Color chips shall be at least six (6) square inches in size, for each color and tint.

1.7 QUALITY ASSURANCE

- A. Applicator: Company specializing in commercial painting and finishing with 3 years minimum documented experience.
- B. Single source responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.
- C. Environmental Requirements for Paints and Coatings:
 - 1. VOC content: Refer to Section 01 81 23 – VOLATILE ORGANIC COMPOUND LIMITS.
 - 2. Do not use water based paints formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure), formaldehyde, halogenated solvents, mercury or mercury compounds, or tinted with pigments of lead, cadmium, chromium VI and their oxides. Water based paints shall be low VOC and shall have a flash point of 61 degrees C or greater.
 - 3. Where it is necessary to use solvent-based paints, with less than 1.0 percent by weight total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).

4. The following shall be low VOC in accordance with Section 01 81 23 – VOLATILE ORGANIC COMPOUND LIMITS, and not be formulated with aromatic hydrocarbons (organic solvent with a benzene ring in its molecular structure).
 - a. High performance water based acrylic coatings.
 - b. Pigmented acrylic sealers.
 - c. Catalyzed epoxy coatings.
 - d. High performance silicone grafted epoxy coatings.
5. Restricted Components: Paints and coatings used on this Project shall not contain any of the following compounds. (Excluded from this restriction are residual quantities of naturally occurring elements and chlorinated organics which are found in chlorinated water supplies; contaminate levels shall be below that of the National Primary Drinking Water Standard):
 - a. 1,2-dichlorobenzene
 - b. Alkylphenol ethoxylates (APEs)
 - c. Formaldehyde-donors
 - d. Heavy metals, including lead, mercury, cadmium, hexavalent chromium and antimony in the elemental form or compounds
 - e. Phthalates
 - f. Triphenyl tins (TPT) and tributyl tins (TBT).

1.8 FIELD SAMPLES

- A. Provide field samples under provisions of Section 01 45 00 - QUALITY CONTROL for purpose of verifying selected colors.
- B. Paint on-site sample areas, minimum 40 square feet, illustrating selected color, and tint.
- C. Locate samples where directed. The Contractor shall provide in the base Contract, a total amount of samples equal to one sample per room.
- D. Accepted samples may not remain as part of the work.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in sealed and labeled containers; container labeling shall include manufacturer's name, type of paint, color mix designation, expected coverage, surface preparation instructions, instructions for mixing and reducing, drying time, and clean-up recommendations.
- B. Store materials, conforming with applicable codes and fire regulations, in designated spaces. Keep storage area secure when direct access is not required or when not performing work under this Section. Take precautionary measures to prevent fire hazards and spontaneous combustion, maintain a dry-chemical type fire extinguisher in all areas where materials of this Section are being stored or used.
- C. Store paint materials in a well ventilated area at minimum ambient temperature of 45 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit.

- D. Do not use the sanitary system for mixing or disposal of refuse material. Carry water to mixing rooms and dump waste material in a suitable refuse receptacle. Remove oily rags and waste each day.

1.10 PROJECT CONDITIONS

- A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees Fahrenheit for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent unless required otherwise by manufacturer's instructions.
- C. Apply paints and finishes above minimum temperature conditions in strict accordance with manufacturer's instructions.
- D. Provide sufficient lighting to maintain 80 foot-candles measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Paints and general finishes:
 - a. Benjamin Moore & Company, Montvale, NJ.
 - b. California Paints, Andover MA.
 - c. Glidden Professional (division of PPG Industries, Inc.), Strongsville, OH.
 - d. Devoe High Performance Coatings (division of PPG Industries, Inc.), Strongsville, OH.
 - e. Pittsburgh Paints / PPG Industries, Inc., Pittsburgh PA.
 - f. Pratt & Lambert Inc., (division of Sherwin Williams), Buffalo, NY.
 - g. Sherwin Williams, Cleveland OH.
 - 2. Anti-graffiti Coatings:
 - a. ProSoCo, Kansas City, KS.
 - b. The Euclid Chemical Company, Cleveland, OH.
 - c. SEI Chemical, Northridge, CA.
 - 3. Cold galvanizing touch-up paint:
 - a. ZRC Worldwide Inc., Marshfield MA.
 - b. Duncan Galvanizing, Everett, MA.
 - c. Rustoleum Corp., Vernon Hills IL.
 - 4. Caulking
 - a. Pecora Corporation, Harleysville PA.
 - b. Sonneborn Building Products Inc., Minneapolis MN.

- c. Tremco, Beachwood OH.

2.2 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.3 MATERIALS

- A. Coatings: Ready mixed, except for field catalyzed coatings with good flow and brushing properties; capable of drying or curing free of streaks or sags. Color pigments shall be processed to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating. Provide best quality grade, where manufacturer makes more than one grade of any material specified.
- B. Joint sealant for fill of minor cracks in plaster prior to painting: One component acrylic latex caulking compound, conforming to FS 19-TP-21M and ASTM C 834, paintable within 24 hours after application, with a minimum movement capability of ± 12.5 percent, equal to one of the following:
 - 1. Pecora, product "AC-20+".
 - 2. Sonneborn Building Products Inc., product, "Sonolac".
 - 3. Tremco, product, "Trimflex 834".

2.4 ACCESSORIES

- A. Accessory materials: other materials not specifically indicated, but are required to achieve the finishes specified of commercial quality.
- B. Cleaning Materials: Tri-Sodium Phosphate (TSP) substitute. Acceptable products include the following, or approved equal:
 - 1. Savogran, Norwood MA, products "TSP-PF", or "Liquid TSP Substitute".
 - 2. Custom Building Products, Seal Beach, CA., product "Custom T.S.P. Substitute".
 - 3. DAP Inc., Baltimore MD., product "T.S.P. Substitute Heavy Duty Cleaner".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify Contractor of any condition that may potentially affect proper application of coatings.
- B. Measure moisture content of surfaces, do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Gypsum board and joint treatment: 12 percent.
 - 2. Masonry or concrete: 12 percent.
 - 3. Interior wood: 15 percent.
 - 4. Exterior wood: 18 percent.

- C. Beginning Work of this Section means acceptance of existing substrate surfaces and site conditions.

3.2 PREPARATION

- A. Furnish and lay suitable drop cloths in all areas where coating work is being done to protect floors and all other surfaces from damage during the work. Protect adjoining surfaces with painters mask tape.
- B. Prior to preparing surfaces or finishing, remove all finish hardware for painting doors and frames, except hinges and locks on exterior door; remove electrical plates, light fixture trim and fittings. Re-install hardware and other removed items after painted surfaces are thoroughly dry.
- C. Mix coatings thoroughly, unless otherwise directed by the manufacturer of the specific coating used, to ensure uniformity of color and mass. Strain previously opened coatings to remove skins, lumps, and other foreign matter prior to painting.
- D. Thin or reduce materials only as recommended by the specific material manufacturer, and only with the approval of the Architect.
- E. Impervious surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to thoroughly dry.
- F. Concrete and unit masonry surfaces scheduled to receive paint finish:
 - 1. Remove all loose scale and mortar, dirt, salt or alkali powder and other surface contaminates, using a detergent expressly formulated for cleaning of concrete and masonry.
 - 2. Remove oil and grease with a solution of tri-sodium phosphate.
 - 3. Remove stains caused by weathering corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
 - 4. Thoroughly rinse the cleaned surfaces with clear water, and allow the surfaces to completely dry, allow a minimum of 4 hours before commencing application of coatings.
- G. Uncoated steel and iron surfaces:
 - 1. Remove grease, scale, dirt, rust, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or sandblasting where heavy coatings of scale are evident.
 - 2. Wash steel with solvent, apply a treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned.
 - 3. Spot prime after repairs with metal primer product of the finish coating manufacturer.
- H. Shop primed steel surfaces:
 - 1. Remove rust, blistered and defective shop prime paint, and all foreign materials, down to bright metal by wire brushing, scraping, sanding, or commercial paint remover. Feather edges to make touch-up patches inconspicuous.
 - 2. Remove all grease or dirt with mineral spirits.

3. Spot prime bare metal with metal primer product of the finish coating manufacturer. Seal top and bottom edges of metals doors with primer.
- I. Previously painted steel surfaces:
 1. Remove rust, blistered and defective paint, down to bright metal by wire brushing, scraping, or sanding. Feather edges to make touch-up patches inconspicuous as possible
 2. Remove grease, dirt and all foreign materials.
 3. Spot prime bare metal with metal primer product of the finish coating manufacturer.
- J. New galvanized surfaces to receive field apply paint:
 1. Prepare surfaces in accordance with SSPC-SP16 to achieve a surface profile of 0.5 to 1.5 mils.
- K. Aluminum surfaces scheduled for paint finish:
 1. Remove surface contamination by steam or high pressure water.
 2. Remove oxidation with acid etch and solvent washing.
 3. Apply etching primer immediately following cleaning.
- L. New interior wood items scheduled to receive paint (opaque) finish.
 1. Smooth minor defects and remove all foreign matter by sanding, and if necessary, steel wool.
 2. Wash sap spots and knots with mineral spirits. When dry, touch up knots, pitch streaks, and sappy sections with commercial stain sealer.
 3. Fill up nail holes and cracks with wood putty or plastic wood after primer of first coat of finish is dry, and sand smooth.
- M. Gypsum board surfaces: Fill minor defects with latex based spackle. Spot-seal all compound surfaces and repair areas in gypsum board, with specified first coat material before application of the first coat.

3.3 APPLICATION

- A. Apply all materials in strict accordance with the approved manufacturer's printed instruction, and in accordance with the best trade practices. Each coat shall be reviewed and approved by the Architect before succeeding coats are applied.
- B. Do not apply successive coating until the preceding coat is thoroughly dry, and in no case in less than 24 hours after the preceding coat.
- C. Number of coats is indicated under Painting Schedules. Number of coats is indicated as a minimum number to be applied over scheduled substrates. An additional coat or coats may be required for proper color coverage of substrate as determined by the Architect, at no additional cost to the Owner. Examples of these conditions include, but are not limited to:
 1. Dark colored substrates may require an additional primer or intermediate coat to stabilize color, if final applied top-coat color is light.

2. Pre-finished or pre-primed products may require an additional field applied coat to stabilize the shop/factory applied base color prior to application of top-coat finishes.
 3. Dark color top coat finishes may require additional finish coat over white or light colored substrates to obtain correct color density.
- D. Apply each coat to a uniform finish; Apply primer and first coat of slightly lighter in color tint than the scheduled color of the final coat.
 - E. Sand lightly between coats to achieve required finish and remove sanding dust prior to applying succeeding coat.
 - F. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
 - G. Prime back surfaces of all interior and exterior woodwork scheduled for painted finish with primer.

3.4 APPLICATION – CONCRETE MASONRY

- A. Apply block filler to concrete masonry partitions at maximum rate allowed by coating manufacturer. Apply by airless spray followed by back rolling to force material into voids. Use a squeegee to remove excess material prior to initial set, and provide a smooth surface texture. After initial set, touch-up and fill apparent voids and holidays with fresh material.

3.5 CLEANING

- A. Upon completion of the work in each area, remove all coating splatters from glass, prefinished surfaces, bright metals, and from other surfaces that have not been painted or finished hereunder. Do not use abrasive paper or abrasive cleaner on any prefinished surface or bright metal. Remove all materials and debris; leave work area in a clean condition.

3.6 PROTECTION AND TOUCH-UP

- A. During painting work, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Properly clean, repair or replace any work so damaged and soiled.
- B. Protect all painted and finished surfaces against damage until the date of final acceptance of the work. The Architect will conduct a final review of all work performed hereunder. Re-coat or touch-up, all scratches and other blemishes on surfaces, and as directed by the Architect, any areas found which do not comply with the requirements of this Section, and bear all costs therefore.
- C. Any re-coating or touch-up work, required after the work of this Section has been reviewed and accepted by the Architect, will be paid for by the Contractor.

3.7 PAINTING SCHEDULE

- A. Colors: The Architect will furnish a schedule of colors for each area and surface. Tinting and matching shall be to the satisfaction of the Architect. No limit is placed on the number of colors that may be required, or the number of colors in any one

room, area, or surface. Premium paints of deep-hued, bright, pigment intensive, accent and primary colors may be scheduled for up to 25 percent of all interior and exterior surfaces without additional cost to the Owner.

1. Colors of priming coats (and body coats where specified) shall be lighter in tint than those of finish coat.
2. Colorants: Pure, non-fading pigments, mildew-proof, ultra-violet resistant, finely ground in approved medium; and be limeproof, when used in coatings to be applied on masonry, concrete, plaster, and gypsum board surfaces.
3. Standard (Typical) wall paint: match Benjamin Moore color number 876, "Alabaster." Having LRV of 87.
4. Accent Colors for Bumper Rails as scheduled, per the following:
 - a. Corridors:
 - 1) Designated PT-1: match Benjamin Moore color number HC115.
 - 2) Designated PT-2: match Benjamin Moore color number HC143.
 - 3) Designated PT-3: match Benjamin Moore color number 299.
 - 4) Designated PT-4: match Benjamin Moore color number 286.
 - 5) Designated PT-5: match Benjamin Moore color number 91.
 - 6) Designated PT-6: match Benjamin Moore color number 285.
 - b. Classrooms:
 - 1) Designated PT-7: match Benjamin Moore color number 399.
 - 2) Designated PT-8: match Benjamin Moore color number 939.
 - 3) Designated PT-9: match Benjamin Moore color number 976.
 - 4) Designated PT-10: match Benjamin Moore color number 1068.
 - 5) Designated PT-11: match Benjamin Moore color number 172.
 - 6) Designated PT-16: match Benjamin Moore color number 117.
- B. Paint schedule for exterior surfaces and materials: Refer to Document 09 91 13.
- C. Paint schedule for interior surfaces and materials: Refer to Document 09 91 23.
- D. Paint schedule for labeling and identifying fire resistive and rated designations : Refer to Document 09 91 23.
- E. Painting schedule for mechanical and electrical equipment: Refer to Document 09 91 23.

End of Section

Document 09 91 13

EXTERIOR PAINTING SCHEDULE
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR EXTERIOR SURFACES AND MATERIALS

- A. Exterior METAL, ALUMINUM, new, mill finish and as scheduled to receive paint:
 - 1. One coat primer:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish", 90 Series.
 - e. Sherwin-Williams: "DTM Acrylic Primer/Finish", B66W1 Series.
 - 2. Two coats 100-percent-acrylic satin paint:
 - a. California: "2010 Acrylic Latex Exterior Eggshell Finish", N°. 401.
 - b. Glidden Professional: Fortis 450 Exterior N°. 6203V.
 - c. Moore: "Aura Exterior Paint, Satin Finish", N°. 631.
 - d. Pittsburgh: "Manor Hall Timeless – Satin", 73-410 Series.
 - e. Sherwin-Williams: "Duration - Satin".
- B. Exterior EXPOSED-TO-VIEW STRUCTURAL STEEL, new, shop primed to Receive Metallic Paint (Bandshell, Canopy and Loading Dock):
 - 1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
 - a. California: "Everlife Oil-based Metal Primer, N°. 21150.
 - b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
 - c. Moore: "Universal Metal Primer" N°. P07.
 - d. Pittsburgh: "Speedhide Industrial Rust Inhibitive Primers", 7-852 Series .
 - e. Sherwin-Williams: "Kem Kromik Universal Metal Primer", B50Z Series.
 - 2. Two coats metallic look finish:

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- a. Metallic-look gloss or semi-gloss finish, in color and finish selected by Architect, equal to Modern Masters (Division of Rust-Oleum Corporation), Vernon Hills, IL.
- C. Exterior METAL, FERROUS, new, shop primed:
- 1. One coat rust inhibitive primer. (touch up bare metal at existing and shop primed surfaces).
 - a. California: "Everlife Oil-based Metal Primer, N°. 21150.
 - b. Devoe Coatings: Devguard 4160 Multi-Purpose Tank & Structural Primer.
 - c. Moore: "Universal Metal Primer" N°. P07.
 - d. Pittsburgh: "Speedhide Industrial Rust Inhibitive Primers", 7-852 Series .
 - e. Sherwin-Williams: "Kem Kromik Universal Metal Primer", B50Z Series.
 - 2. Two coats acrylic enamel, satin finish:
 - a. California: "2010 Acrylic Latex Exterior Eggshell Finish", N°. 401.
 - b. Glidden Professional: Fortis 450 Exterior N°. 6203V.
 - c. Moore: "Aura Exterior Paint, Satin Finish", N°. 631.
 - d. Pittsburgh: "Manor Hall Timeless – Satin", 73-410 Series.
 - e. Sherwin-Williams: "Duration - Satin".
- D. Exterior METAL, GALVANIZED (other than handrails):
- 1. Wash primer apply if recommended by individual paint manufacturer.
 - 2. Touch-up galvanizing primer.
 - a. Devoe Coatings: Devflex 4020PF Direct To Metal Primer and Flat Finish.
 - b. Moore: "Acrylic Metal Primer", N°. M04
 - c. Pittsburgh: "Speedhide Galvanized Exterior Steel Primer", 6-209 Series
 - d. Sherwin-Williams: " Galvite Paint" B50 WZ30 @ 2.5 mils DFT.
 - 3. Two coats of gloss finish alkyd enamel paint.
 - a. Devoe Coatings: Devflex 659 Gloss DTM Waterborne Acrylic Enamel.
 - b. Moore: "Gloss Enamel", N°. M22.
 - c. Pittsburgh: "Speedhide Industrial Gloss Oil Enamel", 7-814 Series
 - d. Sherwin-Williams: "Industrial Enamel", B54 Z Series.
- E. Exterior METAL, RAILINGS, galvanized (handrails and guardrails) to receive - high gloss finish:
- 1. Touch-up cold galvanizing paint.
 - 2. One coat of epoxy primer (dry film coat 3.0 to 4.0 mils)
 - a. California: No equivalent.
 - b. Devoe Coatings: Devran 201H Universal Epoxy Primer.
 - c. Moore: "Superspec HP Epoxy Metal Primer", P33 Series.
 - d. Pittsburgh: "Aquapon WB Epoxy Metal Primer", 98 Series
 - e. Sherwin-Williams: "Heavy Duty Epoxy", B67 Series / B60 V 3 @ 3 mils DFT.

3. Two coats of gloss finish epoxy coating (dry film coat 1.5 to 2.0 mils).
 - a. California: No equivalent.
 - b. Devoe Coatings: Devthane 359 DTM High Build Aliphatic Urethane Gloss Enamel @ 2.0 -3.0 mils DFT.
 - c. Moore: "Superspec HP Aliphatic Acrylic Urethane", P74 Series.
 - d. Pittsburgh: "Pitt-Thane Ultra Urethane Enamel", 95-812 Series.
 - e. Sherwin-Williams: "Hi-Solids Polyurethane-Low VOC", B65 Series/B60 V 30 @ 3.5 mils DFT.

- F. Anti-Graffiti coating over exterior concrete and masonry at indicated/scheduled locations:
 1. Two coats of anti-graffiti coating
 - a. ProSoCo, Kansas City, KS. product "Defacer Eraser® Graffiti Barrier S",
 - b. The Euclid Chemical Company, Cleveland, OH.: product "Euco AG 100."
 - c. SEI Chemical, Northridge, CA., product: Graffiti Proofer, GPC-103"

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Document 09 91 23
INTERIOR PAINTING SCHEDULE
(FILED SUB-BID REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING FILED SUB-BID REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.
- B. General: Number of coats scheduled herein below is minimum required, refer to Article entitled "APPLICATION" in specification Section 09 91 00 - PAINTING, regarding coverage.

1.2 PAINTING SCHEDULE FOR INTERIOR SURFACES AND MATERIALS

- A. Interior CONCRETE MASONRY walls and partitions:
1. One coat block filler:
- California: "Mason-Cote 100% Acrylic Latex Block Filler", N°. 3751.
 - Glidden Professional: Concrete Coatings Block Filler Interior/Exterior N°. 3010.
 - Moore: "Super Craft Latex Block Filler", N°. 285
 - Pittsburgh: "Speedhide Interior Masonry Latex Block Filler", 6-7 Series.
 - Sherwin-Williams: "PrepRite Int. Ext Block Filler", B25-W25 Series.
2. Two coats acrylic semi-gloss paint:
- California: "Fres-Coat Unite100% Acrylic Latex Semi-Gloss", N°. 563.
 - Glidden Professional: Ultra-Hide 250 Semi-Gloss N° 1406.
 - Moore: "Superspec Latex Semi Gloss", 276 Series.
 - Pittsburgh: "Speedhide", 6-500 Series.
 - Sherwin-Williams: "ProMar 200 Latex Semi-Gloss".
- B. Interior underside of METAL DECKING, exposed to view joists, overhead steel, sprinkler piping, conduits, ducts, gymnasium equipment supports, auditorium curtain track, auditorium flying pipes, theater equipment including exposed rigging and hardware, and similar items:
1. Two coats waterborne acrylic dry fall finish:
- California: "Economy Latex Dry Fall Spray Flat", N°. 3701.
 - Glidden Professional: Waterborne Dry Fall Flat N° 1280.
 - Moore: "Sweep-Up Spray Latex Flat, N°. 153.
 - Pittsburgh: "Speedhide Latex Dry Fog Spray Paint", 6-714/715 Series.
 - Sherwin-Williams: "Waterborne Arcylic Dry Fall", B42 Series.

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- C. Interior EXPOSED DUCTWORK, Insulated and Wrapped
1. Apply one prime coat and two finish coats of a paint recommended by the approved paint manufacturer for application on the exposed wrapping material.
- D. Interior GYPSUM BOARD (drywall) partitions:
1. One coat latex primer.
 - a. California: "Elements 100% Acrylic White Primer", N°. 74600.
 - b. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
 - c. Moore: "Ultra Spec 500 Interior Latex Primer", N°. N534.
 - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
 - e. Sherwin-Williams: "Harmony Interior Latex Primer", B11W900 Series.
 2. Two coats eggshell paint:
 - a. California: "Elements 100% Acrylic Zero VOC Eggshell", N°. 731.
 - b. Glidden Professional: Lifemaster No VOC Eggshell N°. 9300.
 - c. Moore: "Ultra Spec 500 Interior Eggshell", N°. N538.
 - d. Pittsburgh: "Pure Performance Eggshell", N°. 9-300.
 - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Eg-Shel", B9 Series".
- E. Interior GYPSUM BOARD (drywall) partitions, and ceilings, at toilet rooms, janitor's closets, food preparation and dishwashing areas for VOC compliant epoxy finish:
1. One coat of sealer,
 - a. California: "Prime Choice ASAP Primer", N°. 50300.
 - b. Glidden Professional: Gripper Primer N°. 3210.
 - c. Moore: "SuperSpec Primer", N°. 253.
 - d. Pittsburgh: "Speedhide Interior Quick Drying Latex Sealer", 6-2 Series.
 - e. Sherwin-Williams: "ProMar 200 Zero VOC Interior Latex Primer", B28w2600 Series.
 - f. Tnemec: PVA 51-792 Sealer.
 2. Two coats of semi-gloss Water Based Acrylic-Epoxy Coatings (3 mils DFT each coat).
 - a. California: No equivalent.
 - b. Devoe Coatings: Tru-Glaze-WB" 4418 Waterborne Acrylic Epoxy Coating.
 - c. Moore: "Corotech WB Amine Epoxy Semi-Gloss", N°. V440.
 - d. Pittsburgh: "Pitt-Glaze Water Based Acrylic Epoxy Enamels", 16 Series.
 - e. Sherwin-Williams: "Water Based Catalyzed Epoxy" B70/B60V15 Series.
 - f. Tnemec: "Tneme-Tufcoat", N°. 112.
- F. Interior GYPSUM BOARD (drywall) ceilings and underside of soffits:
1. One coat latex primer.
 - a. California: "Elements 100% Acrylic White Primer", N°. 74600.

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- b. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
 - c. Moore: "Fresh Start All Purpose Primer", No. 046.
 - d. Pittsburgh: "Pure Performance Interior Latex Primer", N°. 9-900.
 - e. Sherwin-Williams: "Harmony Interior Latex Primer", B11W900 Series.
- 2. Two coats flat paint:
 - a. California: "Elements Zero VOC Flat 100% Acrylic", N°. 733.
 - b. Glidden Professional: Lifemaster No VOC Flat N°. 9100.
 - c. Moore: "Waterborne Ceiling Paint", 508 Series.
 - d. Pittsburgh: "Pure Performance, Flat", 9-100 Series.
 - e. Sherwin-Williams: "Harmony Low Odor Interior Latex Flat", B5 Series.
- G. Interior METAL, ALUMINUM, having "metallic" appearance (includes counter supports and bench supports):
- 1. One coat primer as recommended by paint manufacturer.
 - 2. Finishing, two coats Pre-mixed Metallic Paint:
 - a. Modern Masters Inc. Sun Valley CA., "Metallic Paint Collection", or approved equal.
 - 3. Clear top coat:
 - a. Modern Masters Inc. Sun Valley CA., "Master Clear", semi-gloss, product number ME662, or approved equal.
- H. Interior METAL, ALUMINUM, shop primed (excludes counter supports):
- 1. Touch up bare metal with latex metal primer.
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
 - 2. Two coats acrylic semi-gloss enamel:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: "Super Spec HP DTM Semi-Gloss Enamel", N°. P29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- I. Interior METAL, FERROUS, excluding railings, to receive semi-gloss finish: (includes galvanized metal doors and frames):
- 1. One coat of rust prohibitive primer for unfinished metal surfaces, and touch up bare metal at shop primed, existing and previously coated surfaces:
 - a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.

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- b. Devoe Coatings: Devflex 4020PF DTM Primer and Flat Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish", B66 W1 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Devoe Coatings: Devflex 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
 - c. Moore: "Super Spec HP DTM Semi-Gloss Enamel", N°. P29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- J. Interior METAL, GALVANIZED, (includes exposed ductwork, exposed universal support framing, and exposed galvanized metal fabrications):
1. Touch-up with metal primer.
- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Glidden Professional: "Devflex" N°. 4020 DTM Flat WB Primer/Finish.
 - c. Moore: "Acrylic Metal Primer", N°. P04.
 - d. Pittsburgh: "Pitt-Tech DTM Primer/Finish 100% Acrylic", 90-709/712 Series.
 - e. Sherwin-Williams: "DTM Acrylic Primer Finish" B66 W1 Series.
2. Two coats acrylic semi-gloss enamel:
- a. California: "Rust-Stop DTM Primer/Finish", N°. 1061.
 - b. Glidden Professional: "Devflex 4216HP Semi-Gloss DTM WB Acrylic Enamel".
 - c. Moore: "Super Spec HP DTM Semi-Gloss Enamel", N°. P29.
 - d. Pittsburgh: "Pitt-Tech Plus High Performance, Semi -Gloss DTM Industrial Enamel", 90-1210 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA Semi-Gloss", B66 Series.
- K. Interior exposed METAL, PIPING: Same as specified for ferrous metal.
- L. Interior METAL, RAILINGS (handrails and guardrails):
1. One coat of epoxy primer (dry film coat 3.0 to 4.0 mils)
- a. California: No equivalent.
 - b. Devoe Coatings: Tru-Glaze-WB" 4030 Waterborne Epoxy Primer
 - c. Moore: "Corotech Epoxy Primer", V150 Series.
 - d. Pittsburgh: "Aquapon WB Epoxy Primer", 98 Series
 - e. Sherwin-Williams: "Pro Industrial Pro-Cryl Universal Primer", B66-310 Series.
2. Two coats of satin finish epoxy coating (dry film coat 2.5 to 3.0 mils).

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- a. California: "Tile-Cote Polyamide Epoxy", N°. 12.
 - b. Devoe Coatings: Tru-Glaze-WB 4408 Waterborne Gloss Epoxy Coating.
 - c. Moore: "Corotech WB Amine Epoxy Gloss", N°. V440.
 - d. Pittsburgh: "Aquapon WB Epoxy Coatings", 98 Series.
 - e. Sherwin-Williams: "Waterbased Catalyzed Epoxy, B70W211/B60V15 Series".
- M. Interior WOOD TRIM, new, unfinished, to receive painted (opaque) finish:
- 1. One coat acrylic primer-sealer (undercoater):
 - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
 - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "PrepRite Classic Latex Primer", B28W200 Series.
 - 2. Two coats acrylic eggshell paint:
 - a. California: "Super Scrub Ceramic 100% Acrylic Latex Eggshell", N°. 551.
 - b. Glidden Professional: Diamond 450 Eggshell N° 7200.
 - c. Moore: "Aura Eggshell", N°. 524.
 - d. Pittsburgh: "Manor Hall Timeless Eggshell", N°. 83-310.
 - e. Sherwin-Williams: "Duration Satin", N°. A97.
- N. Interior MDF BUMPERS AND WALL PANELS, new, to receive painted (opaque) finish:
- 1. One coat acrylic primer-sealer (undercoater):
 - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.
 - b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "PrepRite Classic Latex Primer", B28W200 Series.
 - 2. Two coats acrylic gloss enamel:
 - a. California: "Everlife100% Acrylic Waterborne High Gloss", N°. 521.
 - b. Devoe Coatings: Devflex 659 Gloss DTM Waterborne Acrylic Enamel.
 - c. Moore: "Super Spec HP DTM Gloss Enamel", N°. P28.
 - d. Pittsburgh: "Pitt-Tech High Performance, High -Gloss DTM Industrial Enamel", 90-374 Series.
 - e. Sherwin-Williams: "Sher-Cryl HPA", B86 Series.
- O. Interior WOOD TRIM, shop primed and previously painted, to receive painted (opaque) finish:
- 1. Touch up bare wood with acrylic primer-sealer (undercoater):
 - a. California: "Wipe-Out 100% Acrylic Latex Stain Block", N° 52500.

- b. Glidden: Wall and Woodwork Primer Sealer, N° 1020.
 - c. Moore: "Alkyd Enamel Underbody", N°. 217.
 - d. Pittsburgh: "Speedhide Alkyd Interior Quick-Drying Enamel Undercoater", 6-6 Series.
 - e. Sherwin-Williams: "PrepRite Classic Latex Primer", B28W200 Series.
2. Two coats acrylic eggshell paint:
- a. California: "Super Scrub Ceramic 100% Acrylic Latex Eggshell", N°. 551.
 - b. Glidden Professional: Diamond 450 Eggshell N° 7200.
 - c. Moore: "Aura Eggshell", N°. 524.
 - d. Pittsburgh: "Manor Hall Timeless Eggshell", N°. 83-310.
 - e. Sherwin-Williams: "Duration Satin", N°. A97.
- P. Tectum acoustical panels (factory finished in white) to receive field-painted opaque finish:
- 1. Two coats latex acoustically-transparent (non-bridging) paint, in custom colors matching Architect's control sample(s):
 - a. Acoustical Surfaces, Inc., Chaska, MN. product "Sonokote" eggshell,.
 - b. Or approved equal.

1.3 PAINTING SCHEDULE FOR FIRE RESISTIVE AND RATED DESIGNATIONS

- A. In compliance with Massachusetts State Building Code, Eighth Edition (referencing Section 703.6 of the 2009 International Building Code) and as additionally specified herein, provide identification for all fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions and any other wall or partition which is required to have protected openings or penetrations.
- 1. Application:
 - a. Apply to outside of fire rated shafts, and to both sides of partitions at intervals not to exceed 30'-0" for entire length of partition or wall, or once on any partition 30'-0 feet or less in length.
 - b. Locate identification in all accessible concealed floor, floor-ceiling and attic spaces. Locate identification within 12 to 18 inches above finished ceilings.
 - c. Apply stenciled lettering by spray or brush, or provide permanent signage. Identification shall be waterproof, fade-proof and non-combustible. Signage shall be mechanically fastened or permanently adhered to partition.
 - d. Stencil character height: 1 inch minimum.
 - e. Color: Easily identifiable color, contrasting with background, acceptable to Owner.
 - 2. Apply stenciled lettering to the following types of partitions using wording specified:
 - a. Applied identification for 2 hour fire rated partitions shall read: "2 HOUR FIRE WALL - PROTECT ALL OPENINGS".
 - b. Applied identification for 1 hour fire rated partitions shall read: "1 HOUR FIRE WALL - PROTECT ALL OPENINGS".

- c. Applied identification for Smoke barriers shall read: "1 HOUR SMOKE BARRIER - PROTECT ALL OPENINGS".
- d. Applied identification for Smoke partitions shall read: "SMOKE BARRIER PARTITION - PROTECT ALL OPENINGS".

1.4 PAINTING SCHEDULE FOR MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black enamel.
- B. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.
- C. Remove unfinished louvers, grilles, covers and access panels on and paint as scheduled above.
- D. Plywood backboards for electrical panels and other equipment. Paint both front and back surfaces and all edges of plywood backboards before backboards are installed.
 - 1. One coat latex primer-sealer (undercoater):
 - a. Glidden Professional: Lifemaster No VOC Primer N°. 9116.
 - b. Moore: "EcoSpec Interior Latex Primer Sealer" 231.
 - c. Pittsburgh: "Pure Performance Interior Latex Primer".
 - d. Sherwin-Williams: "Harmony Interior Latex Primer" B11W900.
 - 2. Two coats latex semi-gloss paint:
 - a. Glidden Professional: Lifemaster No VOC Semi-Gloss" N°. 9200.
 - b. Moore: "EcoSpec Interior Latex Semi-gloss" N°. 224.
 - c. Pittsburgh: "Pure Performance Interior Semi-gloss", 9-500 Series.
 - d. Sherwin-Williams: "Harmony Interior Latex Semi-gloss" B10 Series.
- E. Prime and paint insulated and exposed cold pipes, conduit, electrical boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are located in storage, mechanical or equipment spaces or those items which are factory prefinished.
- F. Exposed to view un-insulated hot pipes within finished painted areas: Two coats heat-resistant enamel conforming to Federal Specification TT-E-496, Type I, applied when surfaces are less than 140 degrees Fahrenheit.

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Section 09 96 46
INTUMESCENT PAINTS
(TRADE CONTRACT REQUIRED AS PART OF SECTION 09 00 09)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Sub-Bid Requirements: As provided under Section 09 00 09 - PAINTING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 09 00 09.

1.2 SUMMARY

- A. Provide intumescent thin-film coating with protective decorative paint finish for fireproofing as indicated on the Drawings and as specified herein.
1. Provide 2-hour fire-resistant rated Intumescent coating at exposed structural steel, at 'skylight(s)'.
 2. Provide 2-hour fire-resistant rated Intumescent coating at 'Atrium Hangers'.
 3. All preparatory work of materials and surfaces to receive intumescent paint beyond that specified to be done as work of other Sections, shall be included as work of this Section.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 12 00 - STRUCTURAL STEEL FRAMING: Structural steel framing members.
- D. Section 09 91 00 - PAINTING: Field applied coatings, except as specified herein.

1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
1. ASTM D2240 - Rubber Property - Durometer Hardness.
 2. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

3. ASTM D3359 – Standard Test Methods for Rating Adhesion by Tape Test.
4. ASTM D3960 - Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
5. ASTM D4060 - Abrasion Resistance of Organic Coatings by the Taber Abrader.
6. ASTM D823 – Practices for Producing Films of Uniform Thickness of Paint, Varnish and Related Products on Test Panels.
7. ASTM E119 - Fire Tests of Building Construction and Materials.
8. ASTM E2924 – Standard Practice for Intumescent Coatings.
9. ASTM E595 - Total Mass Loss and Collected Volatile Condensable Materials from Out-gassing in a vacuum Environment.
10. ASTM E595 - Total Mass Loss and Collected Volatile Condensable Materials from Out-gassing in a vacuum Environment.
11. ASTM E736 - Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.
12. ASTM E759 - Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members.
13. ASTM E761 - Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.
14. ASTM E84 - Surface Burning Characteristics of Building Materials.
15. AWCI Technical Manual 12-B, Third Edition: Standard Practice for the Testing and Inspection of Field-Applied Thin Film Intumescent Fire-Resistive Materials.
16. IAS AC291 – Accreditation Criteria for Special Inspection agencies.
17. International Standard ISO 20340 – Paints and Varnishes, Performance Requirements for Protective Paint Systems for Offshore and Related Structures.
18. SSPC - SP1 Solvent Cleaning.
19. SSPC - SP2 Hand Tool Cleaning.
20. SSPC - SP3 Power Tool Cleaning.
21. SSPC – SP6/NACE No. 3 - Commercial Blast Cleaning.
22. WH (Warnock Hersey Testing Services): Fire Resistance Directory.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequencing:
 1. Field quality control inspections shall occur prior to application of decorative/protective finish top-coat.
 2. Ducts, piping, conduit, and other suspended equipment which would interfere with the uniform application of the intumescent coating material shall be positioned after application of intumescent coating system.

1.3 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's printed product data, specifications, standard details, installation instructions, use limitations and recommendations for each material used. Provide certifications that materials and systems comply with specified requirements.
 2. Samples: Stepped sample panels consisting of manufacturer approved primer as first or lowest layer.. The middle layer is the intumescent fireproofing (white in color). The topcoat is a low VOC protective topcoat as recommended by manufacturer, and in architect's selected color. The finished application will have a smooth paint like finish without orange peel textured appearance.
 3. Finish Samples: Sample panels of sprayed-on intumescent thin-film coating on 20 gage (minimum) sheet steel, at least 12 by 12 inches, with proposed thickness, color, and surface finish.
 4. Test Reports: Provide certified reports for all specified tests. Submit test designs for intumescent fireproofing prepared by a nationally recognized, certified, independent testing laboratory indicating full compliance with specified fire resistance performance requirements.
 5. Certification:
 - a. Provide certification that contractor/applicator utilized for application of intumescent fireproofing are approved by manufacturer and have attended the manufacturer's required application training.
 - b. Provide certification that specialized equipment as may be recommended by manufacturer for proper application of intumescent fireproofing shall be utilized for Work of this section.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Special Inspections: Submit prior to request for Certificate of Occupancy, to both Architect and local Building Official having jurisdiction, the following:
 - a. All certifications, reports and programs required by Chapter 17 of the Massachusetts State Building code for fireproofing intumescent paint work performed under the requirements of this Section.

1.4 QUALITY ASSURANCE

- A. Source: For each material type required for the work of this section, provide primary materials which are the product of one manufacturer. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.
1. All materials shall conform to all applicable codes and standards, including State and local Building Codes, and shall be acceptable to all authorities having jurisdiction.
- B. Burning Characteristics: Provide materials whose surface burning characteristics, when tested in compliance with ASTM E 84 are Class A.
- C. Tests:

1. Fire Resistance Ratings: Where fire resistant ratings are indicated or required by authorities having jurisdiction, provide materials and construction which are identical to assemblies whose fire resistance ratings have been tested in compliance with ASTM E 119 by independent agencies acceptable to the Architect and all authorities having jurisdiction.
 2. Special Inspections for intumescent fire-resistant coatings shall be in accordance with AWCI-12B.
- D. Qualifications:
1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein, and approved by product manufacturer.
 2. Special Inspector of Intumescent Fire Resistant Coatings:
 - a. The Special Inspector shall be an independent third party hired directly by the Construction Manager.
 - b. Special Inspector Agency (company and Individual) Qualifications: Comply with IAS AC291, and having the competence necessary to inspect the work of this Section 09 96 46
 - c. The Special Inspector (individual) shall have a valid and current ICC Spray-Applied Fireproofing Special Inspector Certificate, or ICC Fire Inspector 1 Certificate with not less than 1 year related experience.
- 1.5 MOCK-UPS
- A. Provide mock-up under provisions of Section 01 45 29 – MOCK-UPS.
 - B. Provide mock-up areas using accepted intumescent coating system, minimum 25 square feet, including primer, intumescent coating and topcoat(s). Mock-up shall illustrate color, texture and finish, and demonstrate the minimum standard for the Work.
 - C. Apply intumescent coating system mock-up at a typical column where directed for joint approval by representative of intumescent coating system manufacturer, Architect, and local code authority having jurisdiction (if required).
 1. Accepted mock-ups may remain as part of the work.
 - D. Applications of intumescent coating system in other areas shall not proceed until sample installation is approved.
 - E. Approved sample installation shall remain in place and open to observation as a standard for intumescent coating work.
- 1.6 DELIVERY, STORAGE, AND HANDLING
- A. Deliver factory mixed materials in original, unopened packages bearing the name of the product, manufacturer's name, and the Underwriters' Laboratories, Inc. label.
 - B. Storage and Protection
 1. Store materials in a clean, dry, protected area. Stack containers raised off ground, using blocking or skids to provide drainage.
 2. Store materials at temperatures not less than 50 degrees F

3. Protect material from freezing.
4. Discard materials which come in contact with contaminants, water, prior to actual use. Remove damaged materials from Site.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Intumescent fireproofing shall not commence or proceed when steel surfaces are below 60 degrees F or when ambient temperature is less than 60 degrees F or expected within 24 hours.
- B. Relative humidity shall not exceed 60 percent throughout total period of application and drying of intumescent fireproofing, and shall not exceed 85 percent throughout application and drying period for protective decorative finish coat.
- C. Provide ventilation in areas to receive intumescent fireproofing during and for 24 hours following application to dry materials.

1.8 PROTECTION

- A. Provide ventilation in areas to receive intumescent coating system during and 24 hours after application, to properly dry material and maintain nontoxic working area,
- B. Protect adjacent surfaces and equipment from damage. Repair damage so caused. Mask adjacent work as required.

1.9 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty: In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
- C. Provide Applicator's certificate stating that intumescent coating system has been completed in full accordance with requirements to provide necessary fire resistance ratings.
- D. Extended Correction Period:
 1. Provide warranty or bond stating applied intumescent coating system will remain free from cracks, checking, flaking, and blistering for Three (3) years from date of Project Substantial Completion, and that failure to provide such performance **will** constitute reinstallation or repair to satisfaction of Owner at no additional cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Albi Manufacturing (Division StanChem, Inc.), East Berlin CT.
 2. AD Fire Protection Systems, Scarborough, ON. Canada.
 3. International Coatings (Division of AkzoNobel),
 4. Isolatek International, Inc. ("CAFCO" Brand), Stanhope NJ.
 5. PPG Protective and Marine Coatings, Pittsburgh, PA.
 6. Sherwin Williams, Cleveland OH.

2.2 DESCRIPTION

- A. Description: Materials, procedures for application, dry densities, and thickness necessary to provide the required protection shall be approved by UL for the uses indicated. Submit certification by an independent Testing Laboratory acceptable to the Owner that materials, thickness, and application procedures satisfy the requirements of the governing laws and building code, and UL requirements, with respect to the minimum protection requirements below when tested in accordance with ASTM E 119.
- B. General Characteristics:
1. Provide materials that have been fire tested and classified by Underwriters Laboratories in accordance with ASTM E 84 and ASTM E 119. Underwriters Laboratories Canada (ULC) certification will be acceptable subject to approval of local authorities having jurisdiction.
 2. Fireproofing Performance: Structural steel members throughout the Project to receive intumescent coating system shall be protected under this Section in accordance with UL Ref. 1 to provide the required fire resistance ratings indicated.
 3. System: Contractor shall assume full responsibility for the proper performance of all materials used, for appropriateness of method of application with respect to materials used and substrates encountered, and for the compatibility of any materials applied with shop coats and other coats previously applied, including primers. Follow manufacturers instructions for compatibility check.

2.3 INTERIOR THIN-FILM INTUMESCENT COATING SYSTEM

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Albi Manufacturing, product "Albi Clad TF".
- B. Interior Intumescent Coating system:
1. Performance Criteria:
 - a. Surface Burning Characteristics (ASTM E 84): rated "Class A".
 - 1) Flame Spread: 0 to 20
 - 2) Smoke Developed: 0 to 50

- b. Hardness (ASTM D 2240): Shore "D" hardness 60-70 (fully cured).
 - c. Bond Strength: 125 psi minimum when tested per ASTM D 4541 or 40 psi minimum when tested per ASTM D 952.
 - d. Impact Resistance (ASTM D 256): 0.77 foot-pounds/inch of notch.
 - e. Abrasion Resistance (ASTM D4060): maximum 103 mg loss for 1000 cycles.
2. Products: Subject to compliance with the requirements specified herein, products which may be incorporated in the work include the following:
 - a. Albi Manufacturing, product "Albi Clad TF".
 - b. AD Fire Protection Systems, Scarborough, ON, Canada, product "A/D Firefilm III".
 - c. International Coatings (division of AkzoNobel), product "Interchar 1120".
 - d. Isolatek International, ("CAFCO" Brand), product "Sprayfilm WB-5".
 - e. Sherwin Williams, product "Firetex FX5120".
- C. Primer: As recommended by manufacturer of intumescent paint, fully compatible with furnished intumescent coating.
- D. Protective Finish Topcoat (Required): Single component, low volatile organic compound (VOC compliant) silicone alkyd or acrylic coating, as required by manufacturer, fully compatible with furnished intumescent coating.
1. Finish topcoat will not affect the fire resistance performance of the intumescent fireproofing
 2. Top-coat Color: Metallic-look gloss or semi-gloss finish, in color and finish selected by Architect, equal to Modern Masters (Division of Rust-Oleum Corporation), Vernon Hills, IL.

2.4 EQUIPMENT

- A. Spray Equipment:
1. Provide airless type equipment recommended by intumescent paint manufacturer. Equipment shall be capable of maintaining rates of pressure measured at spray tip and for volume.
 2. Remove filters and screens except displacement pump filter. Position pressure relief hose in material as far away as possible from pump to maximize recirculation of product.
- B. Miscellaneous Equipment:
1. Provide the following equipment as required to suit project conditions and requirements of the intumescent fireproofing manufacturer for application, curing, and finishing of fireproofing system and verification of required fire ratings:
 - a. Dry film thickness gage.
 - b. Air movement equipment.
 - c. Dehumidification equipment.
 - d. Dry electric heat equipment.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Examine surfaces to which intumescent coating system is to be applied, and notify Architect in writing of conditions detrimental to the proper and expeditious application of intumescent coating system which cannot be corrected by normal cleaning of surfaces. Starting of work within an area shall be construed as acceptance of the conditions of that area.
 - 1. Where painted steel is to be fireproofed with intumescent coating, existing paint surface shall be checked for compatibility with intumescent coating prior to fireproofing application.
 - 2. Where compatibility is a problem, existing steel shall be sandblasted and reprimed with acceptable primer material.
- B. Clean surfaces to receive sprayed-on fireproofing, just prior to the application of the fireproofing, with hand tools (SSPC SP 2), power tools (SSPC SP 3), or solvent cleaning (SSPC SP 1) methods to eliminate mill scale, dirt, grime, oil, grease, dust, loose rust or paint, and all other foreign material which would prevent satisfactory bonding of fireproofing to steel.
- C. Application of intumescent coating system shall constitute acceptance of the suitability of the surface to receive this work by the intumescent coating system applicator.

3.2 VENTILATION

- A. Provide ventilation to properly dry all intumescent coatings during and after its application. In enclosed areas lacking openings for ventilation, circulate exterior air and exhaust it to the outside by use of temporary circulators and exhaust fans.

3.3 MIXING AND APPLICATION

- A. Mixing: Thoroughly mix intumescent fireproofing in accordance with manufacturer's instructions and apply in sufficient thickness to achieve the fire resistance rating. Apply in as many passes as necessary to cover, with uniformed texture. Do not add water or solvent to material
- B. Apply intumescent coating system exactly as described in certificates submitted to prove compliance with specified protection requirements. Control application to maintain uniform quality and thickness.
 - 1. Apply intumescent fireproofing in strict adherence with manufacturer's instructions by spray method. Brush or roller application shall be allowed only when spray application is not practical.
 - 2. Spray apply material using heavy duty, self-cleaning (reversible), type tip; 15 mil to 17 mil in size. Increase distance between tip and surface if necessary to reduce orange peel effect due to pressure. Adjust fan width accordingly.
 - 3. Apply a multiple coat application in accordance with UL Ref. 1. Final wet film thickness application shall meet or exceed that required for specified rating.
 - 4. Prior to drying of surface film, all surfaces shall be rolled to remove unsightly drippings or surface irregularities.

- C. Apply intumescent fireproofing in strict adherence with manufacturer's instructions by spray method. Brush or roller application shall be allowed only when spray application is not practical.
- D. Fireproofing material dries quickly, a viscosity increase may be experienced after container has been opened. Keep container covered as much as possible during application. Use recirculation feature on spray equipment at all times, especially at breaks or interruptions during spraying. Hoses shall be purged with water before breaks or interruptions to spraying process.
- E. When applying fireproofing with roller or brush, work from small containers, mixing frequently. Original pail shall be kept tightly closed and surface of material covered with plastic sheet provided for that purpose.
- F. Fireproofing materials are designed for high build with minimum number of coats, however do not exceed 30 mils per wet coat as shrinkage may occur. AD Base coat to be applied at 65-70 mils / coat with a 24 hour drying time between coats.
- G. Drying time between coats will vary with ambient temperature and humidity conditions. Successive coats shall not be applied until previous coat is dry to touch (approximately 2 hours at 70 degrees F and 50 percent relative humidity). Allow a minimum of 24 hours between application final coat and application of protective topcoat.
- H. Final thickness shall be measured by dry film thickness gage. Do not apply protective top coat until it has been determined that required dry film thickness of intumescent fireproofing has been provided.
- I. Application of Protective Finish Topcoat:
 - 1. Apply protective finish topcoat in strict compliance with manufacturer's instructions by spray method. Brush or roller applications shall be allowed only when spray application is not practical.
 - 2. Spray apply material using manufacturer's recommended airless spray with 2500 pounds per square inch (17.2 MPa) pressure; 0.015 inch (0.4 mm) tip size, and 100 mesh filter.
 - 3. Apply protective finish top coat in compliance with wet and dry film thickness and spreading rates as recommended by manufacturer. Thickness of protective finish coat shall not exceed 4 mils dry per coat.
 - 4. Drying time between coats will vary with ambient temperature and humidity conditions. Successive coats shall not be applied until previous coat is dry to touch (approximately 16 hours at 77 degrees F (25 degrees C) and 50 percent relative humidity).

3.4 FIELD QUALITY CONTROL

- A. Inspection and testing is to be carried out to ensure that applied thickness and adhesion meet fire rating requirements, and to verify installation meets reviewed test reports,
 - 1. Material Characterization Testing: Prior to application, take random liquid samples of intumescent coating materials and submit for material characterization (fingerprinting) in accordance with procedures detailed in ISO

Standard 20340. Submit samples to intumescent material manufacturer for confirmation.

2. Special Inspections for intumescent fire-resistant coatings shall be in accordance with AWCI-12B.
3. Perform Special Inspections prior to application of protective finish top coat. Make available all test results to Construction Manager, Architect, Owner's representative upon completion of each pre-designated work area.

- B. Correct unacceptable work and pay for further testing required to prove acceptability of installation.

3.5 TOUCH-UP

- A. Recoating and/or repairing of intumescent coating system resulting from cutting or damage by other trades shall be performed under this Section and paid for by the trade doing the cutting or causing the damage.

3.6 CLEAN-UP

- A. Upon completion of intumescent coating system work, clean walls, floors, and surrounding surfaces.

End of Section

Section 10 14 00
SIGNAGE

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the interior informational and directional signage as indicated on Drawings, which include, but are not limited to:
 - 1. Exterior cast bronze individual lettering signage (monumental signage).
 - 2. Wayfinding (directional) signage.
 - 3. Fire Alarm Graphics Map signs.
 - 4. Stair signage
 - 5. Room identification signage.
 - 6. Urethane Town Seal.
 - 7. Dedication plaque.
 - 8. LEED-related signage.
 - 9. Evacuation signs.
 - 10. Maximum occupancy signage.
 - 11. Reflective lettering exterior signage.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 01 50 00 - Temporary Facilities and Controls: Temporary project sign and safety signage.
- D. Section 09 91 00 – Painting: Painted graphics and signage.
- E. Division 26 – Electrical: Illuminated exit signs.
- F. Section 32 32 00 - Fieldstone Walls: wall supporting exterior monumental sign.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. All applicable federal, state and municipal codes, laws and regulations regarding accessibility requirements.
- B. Inclusionary References: The following reference materials are hereby made a part of this Section by reference thereto:
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ADAAG: Americans with Disabilities Act Accessibility Guidelines.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, physical properties for each item furnished hereunder.
 - 2. Shop drawings:
 - a. Plan drawing showing location of each sign. Coordinate plan with schedule.
 - b. Elevation drawings showing full size elevations of each sign. Indicate for each sign: sign styles, lettering and locations, and overall dimensions.
 - c. Large scale design details of signs, showing attachment clips and brackets; and complete installation details.
 - 3. Selection samples:
 - a. Sample plastic chips indicating Manufacturer's full range of colors available for initial selection by Architect.
 - b. Sample vinyl lettering colors indicating Manufacturer's full range of colors available for initial selection by Architect.
 - 4. Verification samples:
 - a. Full size sample sign, of type, style and color specified including method of attachment.
 - b. Full size cast letter in specified size, finish and typeface, with mounting collar and stud.
 - c. Full size sign in specified finish and typeface. Approved sample may be used in finished Project.

1.6 REGULATORY REQUIREMENTS

- A. Provide all signage as required by accessibility regulations and requirements of authorities having jurisdiction.
 - 1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding signage for exits and handicapped barriers.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- B. Sole Source: Obtain products required for the Work of this Section from a single signage fabricator, or from manufacturers recommended by the prime signage fabricator of plastic plate signage.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivered packaged signs, labeled in name groups.
- B. Store all materials in an elevated dry location, protected by waterproof coverings. Store adhesive tape at ambient room temperature.

1.9 ENVIRONMENTAL CONDITIONS

- A. Do not install adhesive applied signs when ambient temperature is below 70 degrees Fahrenheit. Maintain this minimum during and after installation of signs.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Interior acrylic signs:
 - a. Signs O'Life, Boston MA.
 - b. Apco New England, Franklin, MA.
 - c. Design Communications, Boston, MA.
 - d. Sunshine Sign, North Grafton, MA.
 - e. General Sign Company, Norwood, MA.
 - f. Back Bay Sign Company, Somerville, MA.
 - g. ASI-Modulex, Inc, Dallas TX.
 - h. Best Manufacturing Sign Systems, Montrose CO.
 - i. DGS Corporation Chicago IL.
 - j. Lynn Sign Company, Merrimac, MA.
 - k. Nelson-Harkins, Chicago IL.
 - 2. High density urethane signage:
 - a. Signs By Tomorrow, Newton, MA.
 - b. Lexington Signs and Grafix, Burlington, MA.
 - c. Foam by Design, Clearwater, FL.
 - d. Coastal Enterprises, Orange, CA.
 - 3. Dedication Plaques:
 - a. ASI Sign Systems, Inc., Dallas TX.

- b. Best Manufacturing, Montrose CA.
 - c. Metal Arts, Mandan ND.
 - d. Mohawk Corporation Chicago IL.
4. Individual letter signage:
- a. A.R.K. Ramos, Oklahoma City OK.
 - b. Gemini Inc., Cannon Falls MN
 - c. Matthews International Corporation, Pittsburgh PA
 - d. Metal Arts, Mandan ND.

2.2 SIGNAGE - GENERAL

- A. General: Provide sign copy to comply with the requirements indicated in the Drawings, for sizes, styles, spacing, content, positions, materials, finishes and colors of letters.
- 1. All Signs shall conform to United States "*Americans with Disabilities Act.*"
 - 2. Final placing and sizing of lettering shall be done as part of the shop drawing approval process, at which time the manufacturer shall make recommendations for Architect's review. Lettering shall have stroke width to height ratio and width to height ratio in accordance with the Americans with Disabilities Act.
 - 3. Tactile Signage:
 - a. Raised Lettering: raised minimum 0.793 mm (1/32 in). and be in compliance with Americans with Disabilities Act.
 - b. Braille: Accurate Grade 2 translations, and conforming to the provisions of ADAAG and ICC/ANSI A117.1 with regard to size, position, spacing, and profile characteristics.
- B. Installation of all signs shall be done by vandal-proof method, fully described on the approved shop drawings.

2.3 MATERIALS

- A. Aluminum:
- 1. Provide alloy and temper recommended by aluminum producer or finisher for the type of use and finish indicated. Provide thicknesses indicated on approved shop drawings.
 - a. Extruded bar and shapes: ASTM B 221, alloy 6063--T6 or alloy 6463--T52.
 - b. Extruded pipe and tube: ASTM B 429, alloy 6063-T6.
 - c. Drawn Seamless tube: ASTM B 483, alloy 6063-T832.
 - d. Plate and sheet: ASTM B209, alloy 6063--T6 or Alloy 3003-H14
 - 2. Aluminum in contact with dissimilar metals shall have bituminous or other protective coating to prevent electrolytic action.'
 - 3. Finish aluminum as indicated on approved shop drawings. Exposed to view aluminum shall be free from scratches and other blemishes. Finish shall be uniform without waves or imperfections of any kind.

4. Recycled content of Aluminum: Use maximum available percentage of recycled aluminum. Aluminum incorporated into the work shall contain not less than 16 percent of recycled aluminum.

B. Bronze:

1. Extrusions CDA 385 (Architectural Bronze) conforming to ASTM B455.
2. Sheet/plate Alloy 230 red brass 85% conforming to ASTM B36
3. Bar stock Alloy 230 red brass 85% conforming to ASTM B36
4. Castings Alloy 836 conforming to ASTM B584.
5. Concealed Fasteners Alloy 651, Low Silicon Bronze.

2.4 REFLECTIVE LETTERING

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Gerber Technology, Product: " Gerber 280 Reflective Sheeting (manufactured by 3M). Lettering 3 inches high in font selected by Architect.
1. Provide reflective lettering in two colors: Gold and White/

2.5 CUT METAL LETTERS

- A. Cut Aluminum letters: Cut with a CNC controlled abrasive WaterJet cutting system. All letter and graphic forms shall have sharp inside and outside corners.
1. Letterforms to conform to vector artwork to be supplied by Architect.
 - a. Letter height: 10 inches.
 2. Letters to be Aluminum Alloy 6061 in 1/2 thickness as described in drawings.
 - a. Finish: color anodized, satin medium to light bronze matching approved shop sample.
 3. Aluminum letters to have a uniform finish. Specific direction will be provided by Architect when color of substrate has been determined so as to provide sufficient visual contrast.
 - a. Coordinate mounting with architectural substrate
 - b. Letterforms will be drilled and tapped for stud mount with spacers.
 - c. Provide mounting template designating stud locations for review and approval prior to installation.

2.6 INTERIOR PLAQUE SIGNAGE

- A. Photopolymer plaque signage (general requirements): Identification signs with raised tactile graphics, text, and Grade 2 Braille. Signs shall consist of 1/32 inch thick synthetic light sensitive photo emulsion permanently bonded to a rigid phenolic substrate, aluminum or acrylic plaque.
1. Raised lettering: Bond photopolymer permanently to sign plaque, with appropriate laminating film, as recommended by the photopolymer manufacturer.
 2. Lettering height: As indicated on Drawings.
 3. Lettering font: As shown on Drawings.

4. Screenprinting: All screen printing graphics, including raised areas of tactile plaques except Braille, shall be screen printed in a contrasting color so as to meet the color contrast requirements of Americans with Disabilities Act.
 - a. All non-tactile text shall be screen printed with catalyzed epoxy ink. Applied vinyl lettering and graphics is not acceptable.
 - b. Apply screen printing inks evenly without pinholes, scratches or orange-peeling.
5. Graphics: All text, symbols and graphics shall be reproduced utilizing computer generated digital art. All screen printed graphics shall utilize photographically prepared screens and shall be printed in accordance with industry standards. Hand-cut screens are not acceptable.
 - a. All edges and corners and letter forms shall be true and clean. Letterforms, color areas, or lines with rounded positive or negative corners, built-up edges, bleeding, spattering, shall not be accepted.
 - b. Prepare artwork from typesetters reproduction of the test specified, minimum 1200 dpi resolution, camera ready artwork. All camera ready artwork and typesetting shall be no less than 75 percent of actual finished size.
6. Mounting: Surface applied by means of silastic adhesive mounting.
7. Sign colors: custom metallic finish, matching Architect's control sample.
 - a. All signs shall be two color signs.
 - b. Sign edges to match color of front.
8. Allow one room identification sign for every room entry door on the plans.

2.7 DEDICATION PLAQUE

- A. Dedication Plaque: Provide a plaque 30 inches wide by 21 inches high minimum.
 1. Letterform: Initial capitals, normal spacing with font directed by Architect, recessed in plaque.
 2. Finish: Enamel background with color to match Architect's sample.
 3. Copy: To be issued. The plaque will include the following:
 - a. Name of Building.
 - b. Name of Selectpersons.
 - c. Names of Building Committee members.
 - d. Name of Architect:
 - e. Name of General Contractor.
 - f. Dedication statement of approximately 500 characters.
 4. Mounting: Concealed, mechanically fastened.
 5. Edge: No raised border edge.
 6. Background Texture: Pebble leather grain.
 7. Metal: Cast bronze
 8. Colors:
 - a. Plaque and field: satin light bronze finish.
 - b. Letters: dark bronze finish.

2.8 ACCESSORIES

- A. Adhesive: Double sided tape, permanent adhesive.
- B. Anchors and inserts for aluminum letters:
 - 1. Aluminum collars, bronze finish to match letter edges.
 - 2. Mounting studs: Threaded type 304 stainless steel studs.

2.9 FABRICATION - GENERAL

- A. Design components to allow for expansion and contraction for a minimum material temperature range of 56 °C (100 °F), without causing buckling, excessive opening of joints or over stressing of adhesives, welds and fasteners.
- B. Form work to required shapes and sizes, with true curve lines and angles. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners whenever and wherever possible.
- C. Shop fabricate so far as practicable. Joints fastened flush to conceal reinforcement, or welded where thickness or section permits.
- D. Contact surfaces of connected members be true. Assembled so joints will be tight and practically unnoticeable, without use of filling compound.
- E. Signs shall have fine, even texture and be flat and sound. Lines and miters sharp, arises unbroken, profiles accurate and ornament true to pattern. Plane surfaces be smooth flat and without oil-canning, free of rack and twist. Maximum variation from plane of surface plus or minus 0.3 mm (0.015 inches). Restore texture to filed or cut areas.
- F. Level or straighten wrought work. Members shall have sharp lines and angles and smooth surfaces.
- G. Extruded members to be free from extrusion marks. Square turns and corners sharp, curves true.
- H. Drill holes for bolts and screws. Conceal fastenings where possible. Exposed ends and edges mill smooth, with corners slightly rounded. Form joints exposed to weather to exclude water.
- I. Finish hollow signs with matching material on all faces, tops, bottoms and ends. Edge joints tightly mitered to give appearance of solid material.
- J. All painted surfaces properly primed. Finish coating of paint to have complete coverage with no light or thin applications allowing substrate or primer to show. Finished surface smooth, free of scratches, gouges, drips, bubbles, thickness variations, foreign matter and other imperfections.
- K. Movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of members. Doors and covers centered in opening or frame. All contact surfaces fit tight and even without forcing or warping components.

- L. Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installation.
- M. No signs are to be manufactured until final sign message schedule and location review has been completed by the Architect and Owner.

2.10 FABRICATION - CUT-OUT METAL SIGNAGE

- A. General: Provide sign copy to comply with the requirements indicated in the Drawings, for sizes, styles, spacing, content, positions, materials, and finishes of signage.
- B. Cut letters and numbers from solid plate material of thickness indicated. Produce precisely cut characters with square cut, smooth edges.
 - 1. Fabrication of metal work: various forms shall be straight and true. There shall be no scratches, scars, creases or buckles.
 - 2. Cut metal letters shall be water jet cut from sheets of thickness as indicated on the approved shop drawings. Letters shall be cut with sharp corners, flat faces, and accurate profiles. Sand sides to smooth finish.
 - 3. Stencil cut metals shall be cut from sheet aluminum. Letters shall be cut true to form, with no irregularities. Remove all burrs and rough spots. Finish all edges same as sign face.
 - 4. Fabricated metal letter forms shall be of solid sheeting, of thickness as indicated on the approved shop drawings. Letter forms shall be rigid, self-supporting and structurally sound. Use brackets and supports as required.
 - 5. All exposed welds shall be filed smooth with all tool marks removed by fine abrasive grain air blasting or other approved method.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

- A. Locate sign units and accessories where indicated, locations in accordance with the approved shop drawings. Use mounting methods of the type described and in compliance with manufacturer's instructions.
- B. Install signs plumb, level and true to height indicated, with sign surfaces free from distortion or other defects in appearance.
- C. Shop fabricate signs where practical and deliver to site completely assembled. All joints of such fabricated work are completely smooth without apparent marks showing throughout the finish. All work "broken down" is erected so that all parts fit accurately with hairline joints, with all joints flush. Joints in lighted signs shall be light-proof.
- D. Wall and door mounted signs: Attach to surfaces as follows:
 - 1. Vinyl Tape Mounting: Use very high bond, double sided foam tape, of thickness indicated, to mount signs to smooth nonporous surface. Use construction adhesive in conjunction with foam tape.

2. Silicone Adhesive Mounting: Use appropriate liquid silicone adhesive to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape to hold the sign in place until the adhesive has fully cured.

3.2 CLEANING

- A. Clean and polish installed signs.
- B. Upon completion of the work of this Section in any given area, remove tools and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Remove all names, stamps and decals of sign manufacturers, and installers. No visible advertising of any kind is permitted.

3.3 SCHEDULE

- A. General: Provide scheduled signs after doors and surfaces are finished, in locations indicated on Drawings, and as additionally directed by Architect/Engineer.
- B. Schedule - Interior Plaque Signage:
 1. Room numbers: For each door frame off corridors, and stairwells, identify room numbers, with 1 inch high die cut lettering. Mount lettering horizontally, centered on door frame at head of door.
 2. At each door to the following room types, provide: nominal 6 by 8 inch size sign, having 1-1/2 inch high letters identifying room label, a maximum of 2 lines of copy, and Grade 2 Braille strip.
 - a. Janitor's Closets
 - b. Elevator Machine Room
 - c. Electrical and Telephone closets.
 - d. Sprinkler Valve Room
 - e. Equipment and Mechanical Rooms.
 3. At toilet room doors: provide: nominal 6 by 8 inch size sign, having 3 inch high international symbol for men/women (as appropriate) beneath provide 5/8 inch high text "MEN" or "WOMEN" (as appropriate), raised 1/32 inch and a Grade 2 Braille strip.
 - a. At each wheelchair accessible toilet room, provide international handicap symbol.
 4. At each corridor door to egress stairs: 8 by 10 inch size, having 3 inch high raised letters identifying "FIRE EXIT," and 1 inch high letter identifying "KEEP DOOR CLOSED." Provide with Grade 2 Braille strip.
- C. Reflective Lettering: Provide at exterior doors (two signs per door), in wording provided by Architect.

End of Section

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Section 10 21 13
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Floor/wall mounted solid plastic toilet partitions with overhead bracing.
 - 2. Metal urinal screens, matching toilet partition design and finish.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: In wall blocking for partition panel support.
- D. Section 10 28 13 - TOILET ACCESSORIES: Furnishing templates, providing and installing toilet accessories surface mounted to toilet compartments, and integral with compartments.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 - 2. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - 3. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 - 4. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

5. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.5 REFERENCES

- A. Comply with applicable requirements of the following standard and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.
 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
 2. ASTM A 666 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 3. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
 4. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 5. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.6 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, and manufacturer's warranty for each item furnished hereunder. Include information panel construction, hardware, and accessories.
 2. Shop drawings:
 - a. 1/2 inch scale dimensioned plans and elevations of each toilet room condition showing toilet compartment and urinal screen layout.
 - b. Large scale design details of showing attachment clips and brackets; and complete installation details.
 3. Samples:
 - a. Selection samples: Manufacturer's full range of color chips, for selection by the Architect; up to two-color combinations for doors and partitions may be selected in each area.
 - b. Verification samples: 6 inch square samples of each color and finish on same substrate to be used in Work, for color verification after selections have been made.

1.7 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for

delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.

1.9 WARRANTY

- A. Furnish the following manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Manufacturer's warranties are in addition to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.
 - 1. Manufacturer's written warranty, for a minimum period of 10 years from date of Substantial Completion. Warranty shall cover panel, pilaster and door material and manufacturing workmanship against defects, including delamination of surfacing, corrosion and breakage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Scranton Products, Moosic, PA.
 - 1. Color: Equal to Scranton "Desert Beige"
 - 2. Face texture: Stipple texture finish "EX".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Accurate Partitions Corp., Lyons IL.
 - 2. General Partitions Manufacturing Corp.
 - 3. Global Partitions, Estanollee, GA.
 - 4. Hadrian Inc., Mentor OH.
 - 5. Knickerbocker Partition Corporation, Freeport NY.
 - 6. Metpar Corporation, Westbury, NY.
 - 7. Scranton Products, Moosic, PA.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire Resistance: Comply with the following requirements:
 - 1. Flame Spread and smoke developed rating, tested per ASTM E-84: Class A flame spread/smoke developed rating.
 - 2. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA) 286: Pass.
 - b. International Code Council (ICC): Class B.

2.3 TOILET COMPARTMENTS

- A. Toilet compartments: Flush type, floor mounted, overhead braced, of standard height and depth, except for sizes of handicapped compartments, which shall be as

indicated on the Drawings. Acceptable models are the following, or approved equal:

1. Accurate Partitions Corp., Lyons IL., "Overhead Braced"
 2. General Partitions Manufacturing Corp., Deer Park NY., style 40.
 3. Global Partitions, Estanollee, GA.
 4. Hadrian Inc., Mentor OH., "Solid Plastic" Partitions.
 5. Knickerbocker Partition Corporation, Freeport NY., series "Metropolitan".
 6. Metpar Corporation, Westbury, NY., series "Overhead-Braced".
 7. Scranton Products, Moosic, PA. "Hiny Hiders" series.
- B. Urinal screens: Flush type, 42 inch high, 18 inches deep matching construction and finish of toilet partitions with continuous wall hung channel support. Acceptable models are the following, or approved equal:
1. Accurate Partition, "Wall hung".
 2. General Partitions, series "WHF-1".
 3. Global Partitions, series "Wall hung".
 4. Knickerbocker, series "WHF".
 5. Hadrian Inc., Mentor OH.
 6. Metpar, type "WH" or type "T".
 7. Scranton Products, Moosic PA. "Hiny Hiders" series

2.4 FABRICATION

- A. General: HDPE solid polymer resin components (pilasters, doors and panels) shall contain a minimum 10 percent recycled material (post-industrial).
- B. Pilasters (stiles): HDPE solid polymer resin, 1-1/4 inch thick, 82 inches high of required depth with uniformly radiused edges in color selected by Architect from manufacturer's full available range of solid colors.
- C. Doors and Panels: HDPE solid polymer resin, 1 inch thick, minimum 55 inches high, of required depth with uniformly radiused edges, in color selected by Architect from manufacturer's full available range of solid colors.
1. Door widths; except as otherwise indicated, provide the following widths:
 - a. Standard stalls, 24 inches [610 mm]
 - b. Handicapped accessible stalls, 36 inches [914 mm] door width having a minimum 32 inch [813 mm] clear opening, or greater.
 2. Fabricate panels and doors with bottom extruded aluminum edging strip
- D. Pilaster floor shoes: 3 inches high formed stainless steel with satin finish, or HDPE in color matching pilasters.
- E. Top bracing: Extruded aluminum channel having "anti-grip" configuration.
- F. Hardware and fittings: Type 302/304 stainless steel or Brite anodized 6463T5 extruded aluminum.

1. Door hinges: Continuous spring loaded hinge for full height of door, through bolted to door and stile with theft resistant one-way screws fastening into receiving metal inserts.
2. Door latch with nylon slides. Door keeper, one piece 11 gage stainless steel.
3. Panel to stile connection: Full panel height "U" shape stainless steel channel.
4. Panel to wall connection: Full panel height "U" shape stainless steel channel or "Double T" shape extruded aluminum channel, clear anodized.

2.5 ACCESSORIES

- A. Equip all doors with combination coat hook and bumper.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify correct spacing of plumbing fixtures.
- C. Ensure wall blocking is coordinated with location of anchors before commencing with installation.
- D. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION - GENERAL

- A. Comply with manufacturer's recommended procedures and installation sequence, and as specified herein.
- B. Install pilasters, partitions, urinal screens, and doors rigid, straight, plumb and level. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Anchor urinal screen panels to walls with two panel brackets and tube vertical upright anchored to floor.
- D. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster. Conceal floor fastenings with pilaster shoes.
- E. Hang door and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- F. Ensure that all holes in partitions, as required for attachment of related items, are accurately located and drilled, in accordance with the templates furnished by the accessory manufacturer. Conceal all evidence of drilling, cutting, and fitting in the finished work.
- G. No permanent exposed to view labels of any kind will be permitted to remain on the partitions, headrails, urinal screens or doors.

3.3 FIELD QUALITY CONTROL

- A. Ensure that all work is free from dents, tool marks, warpage, buckle, open joints, or other defects. Protect compartments during erection, and after erection, and until final approval of the entire project by the Architect.

3.4 ADJUSTMENT

- A. Adjust and align hardware to provide a uniform clearance at vertical edges of doors not to exceed 3/16 inch.
- B. Adjust hinges to locate doors in partial-open position (approximately 30 degrees open) when unlatched. Return outswing doors to closed position.
- C. Test operation of movable parts, and make all adjustments necessary to ensure proper operation.

3.5 CLEANING

- A. Upon completion of the installation, remove all evidence of tapes and other packing materials and thoroughly clean and polish all exposed to view surfaces.
- B. Provide protection as necessary to prevent damage during remainder of construction period.

End of Section

Section 10 21 23
CUBICLE CURTAINS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Surface-mounted cubicle curtain track and guides.
 - 2. Track suspension components and accessories.
 - 3. Curtains.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Above ceiling wood blocking.
- D. Section 09 29 00 - GYPSUM BOARD: Suspended gypsum board ceiling system [to support track].
- E. Section 09 51 00 - ACOUSTICAL CEILINGS: Suspended acoustical tile ceiling system to support track.

1.4 REFERENCES

- A. Reference Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. NFPA 701 - Fire Tests for Flame Resistant Textiles and Films.
 - 2. UL Flammability Test N° 214.
 - 3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 2. Shop drawings:
 - a. 1/4 inch scale reflected ceiling plans indicating view of curtain track, hangers and suspension points.
 - b. Large scale details of track showing suspension system, attachment clips and brackets; and complete installation details.
 3. Selection samples:
 - a. Sample fabric swatches minimum 3 by 5 inch size, indicating manufacturer's full range of colors and textures available for selection by Architect.
 - b. Provide additional samples as requested by Architect for initial selection of colors and finishes.
 4. Verification samples:
 - a. 12 inch long section of track.
 - b. Track splice, wall and ceiling hanger and escutcheon.
 - c. 12 by 12 sample patch of selected [specified] curtain cloth with representative hem stitch detail, heading with reinforcement, and carrier attachment to curtain header.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
1. Maintenance data: Include recommended cleaning methods and materials and stain removal methods.
 2. Bonds and Warranty Documentation: Include coverage of materials and installation and resultant damage from failure of installation to resist penetration of moisture.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
1. Extra Stock Materials:
 - a. Two of each curtain size.
 - b. Ten extra carriers.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 2. Deliver, and store products in manufacturer's original sealed cartons.
 3. Accept curtain materials on site and inspect for damage.

- B. Storage and Handling Requirements:
 - 1. Store and handle materials following manufacturer's recommended procedures. Store curtain materials and deliver to the Owner to installation at Substantial Completion.
 - a. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
 - b. Store in manner to prevent twist or warp of track sections.

1.7 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with trades responsible for installation of suspended ceilings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on A.R. Nelson Company (Arnco), St. Louis, MO.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. A.R. Nelson Company (Arnco), St. Louis, MO.
 - 2. General Cubicle Co. Telford, PA.
 - 3. Imperial Fastener Company, Pompano Beach, FL.
 - 4. Salsbury Industries, Los Angeles CA.
 - 5. InPro Corporation (ClickEZE), Muskego WI.

2.2 DESCRIPTION

- A. Regulatory Requirements
 - 1. Conform to applicable codes for flame/spread rating of 25 for curtains when tested in accordance with ASTM E 84. Provide certificate of compliance from authority having jurisdiction.
- B. Performance/Design Criteria
 - 1. Track: To support vertical test load of 50 pounds without visible deflection of track or damage to supports. Size track to support moving loads.

2. Size track to support moving loads, sufficiently rigid to resist visible deflection and without permanent set.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 CURTAIN TRACK

- A. Track:
 1. Manufacturer's model (or equal):
 - a. A.R. Nelson (Arnco), product: "1200" track. Provide Arnco "1100" track for suspended locations.
 - b. General Cubicle, product: "6062". Provide General Cubicle, product: "6663" for suspended locations.
 - c. Imperial, product: "IFC-98".
 - d. Salsbury Industries, product: "19100".
 - e. InPro (ClickEZE), product: "CE6000 Royal Generic Plus" for both direct mount and suspended locations.
 2. Track shall be extruded aluminum having over-all dimensions of 1-3/8" x 3/4" x 0.062 inch minimum wall thickness. . Design for surface application with side projections to overcome ceiling irregularities and affording a method for scribing a tight, neat line to the ceiling..
 3. Track bends with minimum 12 inch radius, without deforming track section, or impeding movement of carriers. Fabricate in one continuous "L" shape where-ever practical.
 4. Provide extruded slip-on connectors and nylon end stops and gates.
 5. Provide switch for tracks in rooms shown with side by side beds, so that one cubicle can service two beds.
 6. Finish for track and fittings: Clear anodized finish
- B. Roller carriers: Wheeled nylon carrier with self-lubricating nylon wheels and nylon axle, to accurately fit track, designed with "break-a-way" post or hook which will separate from axle assembly when 22 pounds of downward pressure is applied.
 1. Install sufficient quantity of carriers for each curtain, minimum of one carrier for every 6 inches of track.

2.5 CUBICLE CURTAINS

- A. Curtain: Close weave nylon or cotton, anti-bacterial, self deodorizing, sanitized, preshrunk, flame proofed to UL Flammability Test 214.
 1. Solid fabric curtain, 6'-8" inches high, with open nylon mesh at top of curtain for room air circulation.
- B. Manufacture curtains of one pieces, sized 10 percent wider than track length. Terminate curtain 20 inches above finished floor. Provide widths required for locations shown, fabricate curtains from actual field measurements, do not scale from Drawings.

- C. Curtain heading of triple thickness 2 inches wide, with grommetted holes for carriers at 6 inches on center, double fold bottom hem 2 inches wide, included lead weights. Lockstitch seams in two rows. Turn seam edges and lockstitch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and above ceiling supports and verify that they are in proper condition to receive the work of this Section. Verify field measurements are as shown on shop drawings.
- B. Beginning of installation means acceptance of existing surfaces, supports and project conditions.

3.2 INSTALLATION

- A. Install track rigid, and true to ceiling line, secured to ceiling system or to track hangers where suspended systems are required.
- B. Install end cap and stop devices as indicated on approved shop drawings.
- C. Install curtains on carriers ensuring smooth operation.

3.3 CLEANING

- A. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.4 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 10 22 39
FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Acoustical partition with individual panels, manual operation.
 - 2. Standard and segmented-curve ceiling track, ceiling guards, and operating hardware.
 - 3. Shop applied surface finish.
- B. Furnish overhead track attachment brackets to be installed under Section 05 50 00 - METAL FABRICATIONS
- C. Install specified wall fabric for shop [field] application to panels, furnished by Section 09 72 00 - WALL COVERINGS.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 05 50 00 - METAL FABRICATIONS: Overhead track structural support framing.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and track support shimming.
- E. Section 09 29 00 - GYPSUM BOARD: Adjacent ceiling finish.
- F. Section 09 91 00 - PAINTING: Field applied paint finish to panels.
- G. Division 26 - ELECTRICAL: Electric service and empty conduit from partition motor controller to disconnect.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES.

Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.

1. ASTM E 84 - Surface Burning Characteristics of Building Materials.
2. ASTM E 90 - Airborne Sound Transmission Loss of Building Partitions.
3. ASTM E 336 - Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings.
4. ASTM E 413 - Classification for Determination of Sound Transmission Class.
5. ASTM E 557 - Architectural Application and Installation of Operable Partitions.
6. ASTM E 596 - Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures.
7. FS CCC-W-408 - Wall Covering, Vinyl-Coated.
8. NEMA LD-3 - High Pressure Decorative Laminates.
9. PEI - Performance Specifications for Porcelain Enamel Chalkboards.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, sound transmission performance data, physical properties and installation instructions for panel system.
 - a. Provide written test report by test facility for acoustical performance.
 - b. Provide written test report by approved test facility for field tests of acoustical performance of completed partitions.
 2. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage.
 3. Shop drawings: Fully describe partition fabrication, layout and installation.
 - a. 1/4 inch scale elevations and plans of each unique folding partition.
 - b. Large scale design details of ceiling track trolleys and hardware; show attachment to framing; and complete installation details. Indicate tolerances required for framing members.
 4. Selection Samples:
 - a. Sample card indicating Manufacturer's full range of colors available for selection by Architect for vinyl fabric, chalkboards and tack surfaces.
 - b. Provide 24 by 24 inch samples if requested by Architect to assist the initial selection of colors and finishes.
 5. Verification Samples:
 - a. 12 by 12 inch record samples of selected colors and finishes for vinyl fabric, chalkboards and tack surfaces.
 - b. 12 inch long samples of trim in finish specified.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Describe materials detrimental to tackable fabric, and markerboard surfaces and hardware finish.

2. Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable code for combustibility requirements for materials.

1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as shown on approved shop drawings.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver partitions to the project until all concrete, masonry and similar wet work has been completed and dry.
- B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.9 SEQUENCING AND SCHEDULING

- A. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.10 WARRANTY

- A. Submit manufacturer's standard warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 1. Manufacturer's Warranty: Effective from completion date of installation for a period of two years. Warranty shall include the work of this Section and agreement to promptly repair defects and malfunction folding panel partitions. Warranty includes replacement of defective materials, and labor for repairs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Modernfold Inc., Greenfield IN., product "Encore".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Modernfold Inc., New Castle IN.
 2. Hufcor Airwall Inc., Bellflower CA.
 3. Moderco, Inc., Boucherville, Quebec.

2.2 PERFORMANCE REQUIREMENTS

- A. Sound Transmission Coefficient (STC): Standard panel construction (per ASTM E 90), STC of 54 tested on panel size of 100 square feet (9.3 square meters).
 - 1. Acoustical performance shall have been tested at an NIST-accredited, independent laboratory in accordance with ASTM E90-99 or more recent Test Standards.
 - 2. Acoustical performance: NSSEA "Class ratings" are not acceptable in lieu of tested performance.
 - 3. Field tested sound isolation: NIC 46, minimum.
- B. Install partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

2.3 PARTITIONS

- A. Manually operated, center stacking, paired hinged panels, equal to Modernfold "Acousti-Seal Encore", with the following features:
 - 1. Stacking:
 - a. Center stacked.
 - b. Side stacked at double operable partition (located between Band/Chors Rooms).
 - 2. Panel construction: Nominal 4.25-inch (108mm) thick panels in manufacturer's standard 51-inch (1295mm) widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
 - 3. Panel Skin: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction.
 - 4. Panel Finishes.
 - a. Type 1: White magnetic marker board surface, full height, both sides.
 - b. Type 2: White magnetic marker board surface, full height, one side, manufacturer's standard finish on other side.
 - 5. Hinges for Panels, Pass Doors, and Pocket Doors: Full leaf butt hinges, attached directly to the panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.
 - 6. Trim: Trimless appearance.
 - 7. Tray: One recessed chalktray below chalkboards.
 - 8. Provide perpendicular column junction of operable partition at SPED Reading and SPED Resource Rooms. Include reinforcement at long wall to be pinned to the floor at intersection to assure tight seal.
- B. Suspension System:
 - 1. Number 17 Suspension System - Smart Track™.

2. Suspension Tracks: Minimum 11-gage, 0.12-inch roll-formed steel track, supported by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to structural support by pairs of 3/8-inch diameter threaded rods. Aluminum track is not acceptable.
 - a. Exposed track soffit: Steel, integral to track, and pre-painted off-white.
 3. Paired-panel Carriers: Three all-steel trolleys with steel-tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.
- C. Hardware: Latching door handles of cast steel, satin chrome finish.
- D. Acoustic Seals:
1. Panel to panel seals: Grooved and gasketed astragals, continuous flexible vinyl, fitted to panel edge construction; color to match panel finish.
 2. Panel to panel jambs: Flexible acoustic seals at jambs and meeting mullions, ceilings, and floor. Provide retractable seals at floor and ceiling.
 3. Bottom seals: Automatic operable drop seal, activated when panel is in position.
 4. Top seals: Continuous contact multi-finger vinyl sweep seals.

2.4 PANEL FINISH

- A. Customer's Specified Material; Factory supplied & factory applied

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect partition and envelope for compliance with ASTM E557.
- B. Examine flooring, structural support, and opening, with installer present, for compliance with installation tolerance requirements and other conditions affecting operable partition performance. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Confirm track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.
- D. Confirm floor flatness of 1/8 in 10 feet, non-cumulative.
- E. Verify that required utilities are available, in proper location, and ready for use.
- F. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
- B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

- C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
- D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- E. Fit and align partition assembly level and plumb.

3.3 FIELD QUALITY CONTROL

- A. After installation of partitions, field test acoustics to ensure minimum NIC of 46. Adjust, modify or replace partitions to comply with NIC 46 minimum threshold.

3.4 ADJUSTING

- A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.
- B. Visually inspect partition in drawn position for light leaks to identify a potential acoustic leak. Adjust to achieve light seal.

3.5 CLEANING

- A. Clean work under provisions of Section 01 73 00 - EXECUTION.
- B. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- C. Clean finish surfaces and partition accessories.

End of Section

Section 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install toilet, bath and custodial accessories.
- B. Furnish concealed anchorage devices for handicap handrails for installation under Section 06 10 00 - ROUGH CARPENTRY.
- C. Furnish toilet and bath accessory templates, to locate anchorage reinforcement, to trades responsible.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY:
 - 1. Wood blocking.
 - 2. Installation of concealed anchorage devices for grab bars in toilet rooms: Section 10 28 13 - TOILET ACCESSORIES.
- D. Section 09 29 00 - GYPSUM BOARD: Gypsum board substrate.
- E. Section 10 21 13 - TOILET COMPARTMENTS.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ANSI A 117.1 - Specifications for Making Buildings and Facilities Accessible To and Usable by Physically Handicapped People.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, for each item furnished hereunder.
 2. Schedule: Complete schedule, indicating types, quantity, and model numbers of accessories for each location in which the accessories will be installed.
 3. Selection samples: Sample color chips indicating each manufacturer's full range of colors available for selection by Architect.
 4. Verification samples: Complete units, as requested by Architect.
 5. Provide the following LEED submittal items:
 - a. All relevant supporting documentation, as required by LEED for Schools v4 and as detailed in Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.
 - b. A completed LEED Materials Reporting Form, per Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS.

1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable codes and accessibility regulations, and comply with ANSI A 117.1 for installation of work.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing brand name, identification of manufacturer or supplier and item identification number corresponding with approved schedule.
- B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.9 WARRANTY

- A. Deliver to the Owner upon completion of the work of this Section, applicable manufacturer's standard warranties (minimum of two years).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Sheet steel: Cold rolled, commercial quality, ANSI/ASTM A 366.
- B. Stainless steel sheet: ASTM A 167, Type 302/304.
- C. Tubing: ASTM A 269 stainless steel.

2.2 TOILET ACCESSORIES

- A. Manufacturer: To establish a standard of quality, design, function desired, and appearance, Drawings and specifications have been based on manufacturers and model numbers specified herein below. Manufacturers offering products which may be considered as equal include the following:
1. A&J Washroom Accessories, Inc., (A&J) New Windsor, NY.
 2. American Specialties, Inc. (ASI), Yonkers, NY.
 3. Bobrick Washroom Equipment, Inc. (Bobrick), Clifton Park, NY.
 4. Bradley Corporation / Washroom Accessories Division, (Bradley) Menomonee Falls, WI.
 5. VonDrehle Corporation, Hickory, NC.
- B. Baby changing station: Surface mounted diaper changing station equal to Koala Kare Products, Stainless Steel Recessed Mounted Horizontal Design (Model KB110-SSRE) having the following features:
1. Sanitary Liner Dispenser: Koala Kare Products Model KB134-SSLD (Stainless Steel), holds 25 sanitary liners.
 2. Construction: 18 gage Type 302/304 stainless steel exterior finish with FDA approved blow-molded high-density grey polyethylene liner with Microban antimicrobial interior.
 3. Horizontal format design:
 - a. Hinges: Reinforced, full-length steel on steel.
 - b. Mounting supports: multiple 11-gage steel. Secure with Tamper resistant fasteners.
 - c. Operation: Opens and closes with pneumatic gas spring mechanism in concealed cylinder.
 4. Unit rated to support static load of at least 250 pounds (113 kg). Provide test results from licensed independent testing company, manufacturers declarations are not acceptable.
 5. Equip changing station with integral liner dispenser, 2 built-in bag hooks, and child protection safety straps with cam buckle adjustable with one hand.
 6. Instruction graphics/written instructions shall be printed for visibility and permanently engraved into plastic or metal for resistance to vandalism.
 7. Provide safety strap and harness to be secured at four points, closure to be a buckle type.
 8. Unit is to resist bacterial growth. Provide test results that conform to ASTM G-222.
 9. Unit to be cycle tested by licensed independent testing lab for at least 50,000 operations.
 10. Warranty: Furnish manufacturer's 5 year limited warranty on materials and workmanship, and 5 year replacement warranty against vandalism.
- C. Coat/robe hook: Surface mounted satin finish stainless steel double robe hook, fabricated from 22 gage type 304 stainless steel, protrudes from wall nominally 1-7/8 inches.

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1. A&J, model N°. UX112-SF.
 2. ASI model N°. 7345-S.
 3. Bobrick model N°. B-76727.
 4. Bradley model N°. 9124.
- D. Grab bars: Stainless steel, minimum wall thickness 18 gage (Stub's gage), with non-slip knurled, peened or striated surface.
1. Grab bars: 1-1/4 inch diameter with satin finished ends, concealed 1/8 inch thick mounting flange with snap-on cover, 42 inch length, equal to:
 - a. A&J series UG2X.
 - b. ASI series 3700.
 - c. Bobrick series B-5806.99.
 - d. Bradley series 832.
- E. Grab bars at accessible showers are a component of accessible shower units furnished and installed under Division 22 – Plumbing.
- F. Mirrors, framed: 18 inches wide by 36 inches high, having the following:
1. Frame: one piece 1/2 by 1/2 by 1/2 inch type 430 stainless steel channel frame, with continuous integral stiffener on all sides.
 - a. Exposed finish: Brushed satin.
 2. Mirror glass: 1/4 inch thick glass, ASTM C 1048 complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1, with Class 1, standard commercial quality, electro-copper back-plating with a protective finish.
 - a. Mirror corrosion resistant backing shall have minimum 10 year warranty.
 3. Back: Mirror back shall be protected by full-size, shock-absorbing, water-resistant, non-abrasive 1/8" (3-mm) thick polyethylene padding. Galvanized steel backing shall have integral brackets for concealed mounting.
 4. Acceptable models:
 - a. A&J model N°. U711.
 - b. ASI model N°. 0620-B.
 - c. Bobrick model N°. B-165.
 - d. Bradley model N°. 781.
 - e. Meek model N°. 1510.
- G. Mop and broom holders: Surface mounted, nominal 44 inch long stainless steel unit with 18 gage 8 inch deep continuous shelf, 5 stainless hooks and 4 mop/broom holders, anti-slip spring loaded, rubber cam mop holders, capable of holding 7/8 to 1-1/4 inch diameter handles.
1. A&J series UJ45B.
 2. ASI model 1308B.
 3. Bobrick model N°. B-239-44.
 4. Bradley model N°. 9934.

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- H. Sanitary napkin disposal: Surface mounted feminine napkin disposal unit, fabricated of type 304 stainless steel, with one piece cover.
1. A&J, model N°. U591
 2. A.S.I., model 0852
 3. Bobrick model B-270 ("Contura" Series)
 4. Bradley model N°. 4722-15
- I. Shower Seats are a component of accessible shower units furnished and installed under Division 22 – Plumbing.
- J. Shower curtains and rods:
1. Curtain rods: 1-1/4 inch diameter, Stainless steel, minimum wall thickness 18 gage (Stub's gage), with stainless steel 2-1/2 inch flange and concealed fasteners. Lengths for locations shown on the Drawings.
 - a. ASI model 1206
 - b. Bobrick model B-6047.
 2. Curtain hooks: 18-8, type 304 Stainless steel, 0.09 inch diameter. Provide one hook for every 6 inches, or fraction thereof of each curtain rod.
 3. Polyester shower curtain: white, 100 percent polyester mildew resistant, Teflon coated for water repellency and stain resistance. Fabricate curtain with hemmed edges and a fully weighted, anti-fungus, mildew resistant bottom hem and corrosion-resistant grommets along reinforced top edge every 6 inches (152 mm) on center through top hem.
- K. Shelving: Custodial shelf, stainless steel, 6 inches deep by 18 inches wide with 3/4 inch edge return. Mounting brackets, 16 gage welded to shelf.
1. A&J model N°. U776.
 2. ASI model N°. 0692.
 3. Bobrick model N°. B-296.
 4. Bradley model N°. 756.
- L. Toilet tissue dispenser: Surface-mounted, jumbo-roll, toilet tissue dispenser, constructed of type-304 stainless steel. Dispensing mechanism accommodate two 10" (254-mm) diameter toilet tissue rolls; and be equipped with a sliding access panel that exposes one roll at a time. Spindles shall be convertible in the field to dispense 3" or 2-1/4" (76 or 57 mm) diameter core rolls with use of removable core adapters furnished.
1. A&J model N°. U834.
 2. ASI model N°. 0040.
 3. Bobrick model N°. B-2892.
 4. Bradley model N°. 5425.
- M. Towel dispenser: OFCI, Owner Furnished Contractor Installed.
- N. Waste receptacles: Loose, furnished under separate FF&C contract.

- O. Soap Dispenser: Owner Furnished Owner Installed. Coordinate and provide blocking as required to properly mount dispensers where indicated on the Drawings.

2.3 LOCKS

- A. General: All locks shall be keyed alike. Provide four (4) keys, for lockable accessories, to the Owner.

2.4 INSTALLATION ACCESSORIES

- A. Fasteners, screws, and bolts: Type 304 stainless, tamperproof.
- B. Expansion shields: Fiber, lead or rubber as recommended by accessory manufacturer for component and substrate.

2.5 FABRICATION

- A. Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion, scratches or dents. Weld and grind smooth joints of fabricated components.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.
- C. Shop assemble components and package complete with anchors and fittings. Hot dip galvanize exposed and painted ferrous metal and fastening devices. Provide steel anchor plates, adapters, and anchor components for installation.

2.6 FACTORY FINISHING

- A. Ferrous metals: Clean and treat, spray apply one coat of baked-on rust and moisture-resistant primer, followed by two coats of baked-on synthetic enamel, in selected colors. Ensure that finish coating is uniform in color intensity and degree of gloss, throughout.
- B. Chrome/Nickel Plating: ASTM 456, Type SC2, satin finish.
- C. Stainless steel: Number 4 satin finish, except as otherwise specified above under the Article entitled "Toilet Accessories".

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide templates and rough-in measurements. Deliver inserts and rough-in frames to site at appropriate times for building-in by other trades
- B. Coordinate with trades responsible for providing receiving surfaces on which accessories will be installed.
- C. Exact locations of accessories within each room or area shall be as directed by the Architect.

3.2 INSTALLATION

- A. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- B. Install toilet accessories absolutely level and in true line, securely and rigidly anchored with theft proof fasteners of the size and type most appropriate for the specific receiving surface, concealing the fasteners as far as practicable.

3.3 ADJUSTING

- A. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.4 CLEANING

- A. Remove all protective films and coverings from accessories, and clean and polish each piece. Remove all rubbish, packing materials, and debris, caused by the work of this Section.

End of Section

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Section 10 40 00
SAFETY SPECIALTIES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Fire extinguisher cabinets and brackets.
 - 2. Hose connection cabinets.
 - 3. Fire extinguishers.
 - 4. Defibrillators and cabinets.
 - 5. First aid kits.
 - 6. Fire department access emergency key cabinets.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 04 20 00 - UNIT MASONRY: Concrete masonry unit partitions.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood rough-in framing and blocking.
- E. Section 09 22 16 - NON-STRUCTURAL METAL FRAMING: Framed wall openings
- F. Section 09 29 00 - GYPSUM BOARD: Gypsum wallboard finishes.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. NFPA 10 – Standard for Portable Fire Extinguishers, 2018 Edition.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, indicating: fabrication specifications, finishes, dimensions of cabinet and rough opening, and installation instructions.
 2. Shop drawings: Details showing unit dimensions, methods of construction, attachment clips and brackets; and complete installation details.
 3. Selection samples: Samples indicating metal finishes available for selection by Architect.
 - a. Provide additional samples as requested by Architect to facilitate initial selection of colors and finishes
 4. Verification samples: Fire extinguisher cabinet in specified size, finishes, and door type, if requested by Architect.

1.6 REGULATORY REQUIREMENTS

- A. Obtain certificate of compliance from authority having jurisdiction indicating approval of fire extinguisher cabinets and their installed locations.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver cabinets or extinguishers to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store cabinets and extinguishers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY CHARACTERISTICS

- A. Sustainability Characteristics for each Sustainability Focus Material in Accordance with Section 018113 Appendix A and Appendix B.

2.2 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. J.L. Industries, (Division of Activar Inc.). Bloomington MN.
 2. Larsen Manufacturing Co., Minneapolis MN.
 3. Potter-Roemer, Union NJ.

2.3 FIRE EXTINGUISHERS CABINETS

- A. Fire extinguisher cabinets: Fully recessed, trim-less cabinet with 5/8 inch thick door with concealed hinge. When door is closed it covers the cabinet's flange and hinge.
1. Cabinet construction:

-
- a. Non-rated cabinet construction: 18 gage cold-rolled steel with factory applied baked acrylic enamel corrosion-resistant finish.
 - b. Fire-resistance rated cabinet construction for up-to a two hour wall rating: 18 gage cold-rolled steel double wall construction with fire barrier material lining in compliance with ASTM E-814 (UL1479). Provide cabinet with factory applied baked acrylic enamel corrosion-resistant finish.
 - c. Cabinet color: Custom, satin bronze metallic finish.
2. Door: Solid Bronze with polished (satin) finish.
 - a. Vertical duo design with clear tempered safety glass.
 - b. Handles: Recessed door handle matching material and finish of door.
 - c. Lettering: Factory furnished decals for field application, as directed by Architect.
 - 1) Pattern: Vertical reading.
 - 2) Color: White
3. Acceptable models (Typical):
 - a. Non-rated cabinets with bronze door:
 - 1) JL Industries "Embassy Series", model number 5654.
 - 2) Larsen "Occult Series", model number O-3216BZ.
 - 3) Potter-Roemer, no equal model.
 - b. Fire-resistant rated cabinets with bronze door:
 - 1) JL Industries "Embassy Series", model number 5654-FX.
 - 2) Larsen "Occult Series", model number FS O-3216BZ.
 - 3) Potter-Roemer, no equal model.
4. Acceptable models (Kitchen and Food Service Areas only):
 - a. Non-rated cabinets with stainless steel door:
 - 1) JL Industries "Embassy Series", model number 5734.
 - 2) Larsen "Occult Series", model number O-3216SS.
 - 3) Potter-Roemer, "Dana Series", model number 7265.
 - b. Fire-resistant rated cabinets with stainless steel door:
 - 1) JL Industries "Embassy Series", model number 5734-FX.
 - 2) Larsen "Occult Series", model number FS O-3216SS.
 - 3) Potter-Roemer, "Dana Series", model number 7265-FRC.

2.4 FIRE HOSE CABINET

- A. Fire hose cabinets:
 1. Cabinet construction:
 - a. Non-rated cabinet construction: 18 gage cold-rolled steel with factory applied baked acrylic enamel corrosion-resistant finish.
 - b. Fire-resistance rated cabinet construction for up-to a two hour wall rating: 18 gage cold-rolled steel double wall construction with fire barrier material lining in compliance with ASTM E-814 (UL1479). Provide cabinet with factory applied baked acrylic enamel corrosion-resistant finish.
 - c. Cabinet color: White.

2. Cabinet trim style: Surface mounted.
3. Door: Cold-rolled steel with factory applied white thermally fused polyester coating, acceptable to receive a field applied recoating with 5/8 inch (15.88 mm) door stop attached by continuous hinge and equipped with black ABS recessed pull with roller catch.
 - a. Style: Solid panel doors.
 - b. Lettering: Factory applied die-cut lettering, applied to metal portion of door.
 - 1) Pattern: Vertical reading.
 - 2) Color: Red
4. Acceptable models for surface mounted cabinets:
 - a. JL Industries "Crownline", model number 6514B10FX2.
 - b. Larsen. Approved equal
 - c. Potter-Roemer. Approved equal.

2.5 FIRE EXTINGUISHERS WALL MOUNTING BRACKETS

- A. Wall mounting Bracket: 16 gage steel surface mounted bracket, with red glossy polyester thermo-set coating, equal to the following. Provide with red letter decals spelling "FIRE EXTINGUISHER" applied to wall surface, letter size, style as required by code, location as selected by Architect.
 1. JL Industries, model number "MB-810".
 2. Larsen model number 864.
 3. Potter-Roemer, model number 3903.

2.6 FIRE EXTINGUISHERS

- A. Extinguishers: Non-toxic Multi-purpose dry chemical type (mono ammonium phosphate), 10 pound capacity, multi-purpose rated '4A, 80B:C'; Heavy Duty DOT Steel Cylinder Extinguisher with metal valves and siphon tubes, replaceable molded valve stem seals, corrosion and impact resistant polyester/epoxy paint finish, pull pin-upright squeeze grip operation, and pressure gauges.
- B. Extinguishers (Kitchen and Food Service): Wet chemical type (potassium acetate based), 2-1/2 gallon capacity, rated '2A:K'; with metal valves and siphon tubes, replaceable molded valve stem seals, pressure gauges and hose discharge.

2.7 EMERGENCY AID SPECIALTIES

- A. Defibrillator cabinet: Recessed cabinet, 14 inches by 14 inches by 6 inches equal to Phillips Model No. "AMP180RM".
- B. Automated External Defibrillator:
 1. Basis of Design: Philips Heart Start OnSite HS1 Defibrillator.
 2. Defibrillator Model: Automatic external defibrillator with adult defibrillation peak current of 32A (150J nominal) into a 50 ohm load and pediatric defibrillation peak current of 19A (50J nominal) into a 50 ohm load, complying with AAMI DF80 guidelines and AHA recommendations for adult defibrillation equal to Phillips Model "HeartStart M5066A".
 - a. Capacity: Minimum 200 shocks or 4 hours of operating time.

3. Unit includes:
 - a. Defibrillator unit.
 - b. Battery: 9 Volt DC, 4.2 Ah disposable long-life lithium manganese dioxide primary cells equal to Phillips Model No. M5070A, pre-installed.
 - c. Adult pads cartridge equal to Phillips Model M5071A.
 - d. Infant/Child pads cartridge equal to Phillips Model M5072A.
 - e. Quick reference guide.
 - f. Setup and maintenance guide with expiration date tags.
 - g. Owner's Manual.
4. Accessories:
 - a. Adult training pads cartridge equal to Phillips Model M5073A.
 - b. Infant/Child training pads cartridge equal to Phillips Model M5074A.
 - c. Data Recording and Transmission: Infrared IrDA protocol.
 - d. Alarm: Standard key activated alarm, activated when door is opened to remove the defibrillator; 120db.

2.8 EMERGENCY KEY CABINETS

- A. Fire department emergency access key cabinet ("Knox Box"): Model 3200-R, Knox Rapid Entry System box, heavy duty, medium capacity (10 keys), recessed mounted with optional recessed masonry mounting kit, as manufactured by The Knox Company, Phoenix, AZ, or equal having the following construction:
 1. Housing: 1/4 inch thick plate steel with joints welded.
 2. Door: 1/2 inch thick steel plate with neoprene weather seal.
 3. Locking: 3 point lock with stainless steel lock cover.
 4. Tamper switch: Provide optional UL listed alarm tamper switch.
 5. Finish: Dark Bronze powder coat.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify that prepared openings are ready to receive extinguisher cabinets.
- C. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions in locations indicated, and as additionally directed by regulatory authority having jurisdiction.
 1. Refer to Drawings for quantities and locations.
- B. Do not commence installation of safety specialties until immediately adjacent surfaces have been completely installed and finished.

- C. Install absolutely level and in true line, with units securely anchored to the surrounding construction. Fit trim pieces accurately and tight to adjacent construction.
 - 1. Maximum variation from plumb and level: 1/8 inch.
 - 2. Maximum offset from true dimensional alignment: 1/4 inch.

3.3 CLEANING AND ADJUSTMENT

- A. Upon completion of the work of this Section in any given area, remove tools, and all packaging and debris from the work area; leave area in broom-clean condition.
- B. After adjacent work is complete:
 - 1. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
 - 2. Remove all tape and other packing materials from fire extinguisher cabinets .
 - 3. Thoroughly clean and polish all exterior and interior surfaces of extinguisher cabinets, take care to remove dirt from corners. Clean metal and [glass] [plastic] surfaces with mild cleaning agents as recommended by manufacturer.
 - 4. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.
- C. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

Section 10 51 13
METAL LOCKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Metal lockers, for complete with all required tops, closures and filler pieces.
 - 2. Wood locker room benches.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate 3, which affects the scope of work for this Section 10 51 13.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Concrete slab curbs at locker rooms.
- E. Section 10 51 23 – PHENOLIC LOCKERS

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - 2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.
 - 3. Shop drawings:
 - a. 1/4 inch scale (minimum) plans of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items.

- b. Large scale details of locker and bench construction, showing filler panels, sloping top components, attachment clips, brackets and complete installation details.
- 4. Selection samples: Manufacturer's color chips, comprising at least 8 different colors, for selections by the Architect.
- 5. Verification samples:
 - a. one full sized student locker.

- B. Submit manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.5 QUALITY ASSURANCE

- A. Obtain locker and benches from a single manufacturer, or from manufacturers recommended by the prime manufacturer of lockers.
- B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.
- C. Qualifications:
 - 1. Manufacturer, with a minimum of 3 years experience demonstrating previously successful work of the type specified herein.

1.6 MOCK-UPS

- A. Provide mock-up of Locker Type 3 under provisions of Section 01 45 00 - QUALITY CONTROL.
- B. Provide full sized mock-up lockers (Type 3) using accepted paint colors, illustrating workmanship, colors, and finish, and demonstrating the minimum standard for the Work.
 - 1. Provide one locker for each of the four colors required.
- C. Locate mock-ups where directed.
- D. Maintain mock-up during construction for workmanship comparison; remove and legally dispose of mock-up when no longer required.
- E. Accepted mock-ups may remain as part of the work; the number of mock-ups shall not be restricted.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.9 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance.
 - 1. Provide spare keyed cylinders (with keys), an amount equal to 10 percent of total lockers.
 - 2. Provide two master keys.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Debourgh Manufacturing Company, La Junta CO.
 - 2. Hadrian Inc., Mentor, OH.
 - 3. List Industries, Inc., Deerfield Beach, FL.
 - 4. Penco Products, Inc., Oaks PA.
 - 5. Republic Storage Systems Company, Inc., Canton OH.

2.2 MATERIALS

- A. Sheet Steel: Mild cold-rolled and leveled steel, free from buckle, scale, and surface imperfections.
- B. Fasteners: Cadmium, zinc, or nickel plated steel; exposed bolt heads, slotless type; self-locking nuts or locker washers for nuts on moving parts.
 - 1. Locker assembly fasteners shall be "pop" type rivets with aluminum bodies and steel mandrels. Rivets shall be backed up by washers to ensure correct rivet expansion and secure fastening.
- C. Equipment: Hooks and hang rods of cadmium-plated or zinc-plated steel or cast aluminum.

2.3 LOCKER TYPES

- A. Locker Type 1 (Kitchen Staff, and Locker Rooms): Double tier wardrobe locker 15 inches wide by 15 inches deep by 72 inches high at front, with 36 inch compartment height.
1. General design, equal to Republic Storage Systems Company, Inc., Canton OH; product: "Heavy Duty Corridor Series Locker".
 2. Body: Backs, sides, tops, bottoms and shelves sides minimum 24-gage. Flange tops, bottoms and shelves on four sides, and backs on two sides.
 - a. Form exposed ends of non-recessed lockers of minimum 16-gage steel.
 - b. Lower shelf:
 - 1) Standard locker: 6 inches above finished floor.
 - 2) Handicapped accessible locker: 9 inches above finished floor.
 - c. Top shelf:
 - 1) Standard locker: Manufacturer's standard height.
 - 2) Handicapped accessible locker: 48 inches above finished floor.
 3. Door frame: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.
 4. Door: Flush design without louvers or perforations, 14 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Perforate top and bottom flanges for locker ventilation. Fabricate to swing 180 degrees.
 5. Hinges: Two 5-knuckle, 2 inch high full loop pin hinge welded to frame and riveted to inside of door flange.
 6. Door handle:
 - a. Latch design: operable by "club fist" as required by Massachusetts Architectural Access Board Regulations.
 - b. Latching method: three point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Lock bar is limited in travel by concealed elastomeric cushioning devices. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.
 - c. Pocket: Recessed formed 20 gage stainless steel pocket encased with molded ABS thermoplastic cover.
 7. Locking method - Built-in Combination Locks: All lockers shall be equipped with built-in combination locks. Locks shall have three-number combination dialing and be capable of at least five different combination changes.
 - a. Locks are to be installed on lockers using security-type machine screws.
 - b. Provide Owner with Master key and combination change key chart and combination control charts upon completion of locker installation.
 8. Base: Closed 16 gage "Z-base", 6 inches high.
 9. Filler panels: 18 gage steel minimum, factory-fabricated and finished to match locker units.
 10. Trim: 18 gage steel minimum; Provide at jambs and head of recessed lockers, finished to match locker units. Secure with concealed fasteners.
 11. Accessories:

-
- a. Double prong hook mounted to underside of locker top or back of locker.
 - b. Single prong hook mounted on each side of locker.
 - c. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.
 - d. Handicapped accessible locker.:
12. Finish: Powder coat finish,
 - a. Finish: Kitchen Staff single color selected by Architect from manufacturer's standard colors.
 - b. Finish: Locker Rooms up to two custom colors matching Architect's control samples.
- B. Locker Type 2 (Custodian lockers): Single tier locker 15 inches wide by 15 inches deep by 72 inches high at front.
1. General Design: Same as Locker Type 1 except as modified above.
 2. Finish: Powder coat finish, in single color selected by Architect from manufacturer's standard colors.
- C. Locker Type 3 (Atrium lockers): Single tier locker 18 inches wide by 12 inches deep by 39 inches high at front.
1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Hadrian Inc., Mentor, OH., product "Emperor Locker", with solid front."
 2. Body: Backs, sides, tops, bottoms and sides minimum 24-gage. Flange tops and bottoms on four sides, and backs on two sides.
 - a. Form exposed ends of non-recessed lockers of minimum 16-gage steel.
 3. Door frame and cross members: 16 gage channel or 12 gage angles, with continuous door stop/strike integral with frame on both sides of opening.
 4. Door: Flush design without louvers or perforations, 16 gage steel, formed with full channel shape on lock bar side, channel formation on hinge side and flanged top and bottom. Fabricate to swing 180 degrees.
 - a. Quieting Pans: Provide quieting pans welded to inside of doors to reduce noise.
 5. Hinges: Provide 2 five-knuckle, 2 inch high full loop pin hinges welded to frame and riveted to inside of door flange.
 6. Door handle:
 - a. Latching method: two point latching with spring steel latch contained in a lock bar under tension. Lock bar contained in door channel by self-lubricating polyethylene guides. Provide frame hooks welded to door frame, furnished with soft rubber silencers at each hook.
 - b. Pocket: Recessed formed 20 gage stainless steel pocket encased with molded ABS thermoplastic cover.
 - c. Locking method: door handle latch design capable of receiving user furnished padlocks.
 7. Base: Closed 16 gage "Z-base", 6 inches high.
 8. Filler panels: 18 gage steel minimum, factory-fabricated and finished to match locker units.

9. Trim: 18 gage steel minimum; Provide at jambs and head of recessed lockers, finished to match locker units. Secure with concealed fasteners.
10. Accessories:
 - a. Double prong hook mounted to underside of locker top or back of locker.
 - b. Number Plates: Provide each locker door with polished aluminum number plate with black numerals not less than 1/2 inch height.
11. Finish: Powder coat finish, up to four custom colors matching Architect's control samples.

2.4 LOCKER ROOM BENCHES

- A. Fixed-in-place benches (permanent), factory fabricated:
 1. Tops: Laminated maple, 9-1/2 inches wide by 1-1/4 inches thick of lengths indicated, sealed and varnished.
 2. Pedestals chromed-steel tubing, 1 inch inside diameter with 10 gage flanges welded to each end.
 3. Overall seating height shall be between 17-1/2 to 18 inches.

2.5 FACTORY FINISHING

- A. Clean, degrease, and neutralize metal; prime and finish with two coats of baked enamel finish.
 1. Colors of locker bodies and doors as selected from manufacturer's standard range. Up to four colors may be selected for each locker type.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

- A. During the operation of work of this Section, protect the work of other trades against undue soilage and damage by the exercise of reasonable care and precautions. Repair or replace any work so damaged and soiled to match original finishes.

3.3 INSTALLATION

- A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Furnish and install all sloped top pieces as required, refer to the Drawings for the various conditions.

- D. Furnish and install all filler pieces as required to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.
- E. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation. Conceal screw heads and bolts as far as practicable, leaving exposed panels completely free from unused bolt holes.
- F. Locate locker benches where shown on the Drawings.

3.4 ADJUSTING AND CLEANING

- A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
- B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.
- C. Touch-up all scratches and other surface defects, using same materials and colors as shop finish.

3.5 PROTECTION

- A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

End of Section

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Section 10 51 23
PHENOLIC LOCKERS
(ALTERNATE)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Under Alternate Number 3; furnish and install single tier solid core, color matched with integrally bonded decorative "matte finish" melamine surface phenolic lockers, for installation on wood curb framing, complete with all required trim, closures and filler pieces.

1.3 RELATED REQUIREMENTS

- A. Section 01 23 00 – ALTERNATES: Alternate 3, which affects the scope of work for this Section 10 51 23.
- B. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- C. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- D. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking and nailers.
- E. Section 10 51 13 – METAL LOCKERS.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - 2. Warranty: Provide sample copies of manufacturers' actual warranties, clearly defining all terms, conditions, and time periods for the coverage thereof.
 - 3. Shop drawings:
 - a. 1/4 inch scale (minimum) plans of each area with specified lockers, include layout of all lockers, closures, and filler panels and large scale details of locker construction; and details of accessory items.

- b. Large scale details of locker and bench construction, showing filler trim, end and edge panels, attachment clips, brackets and complete installation details.
- 4. Verification samples: Two 12 x 12 inch samples of selected laminate with edging.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not order or fabricate lockers, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Store lockers inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- C. The locker manufacturer, locker installer and the Contractor are all jointly responsible to make certain that casework is not delivered until the building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in ambient humidity and relative moisture content.
- D. Concrete, masonry, plaster, tile and marble setting and polishing and other wet work shall be completed and dry before delivery, storage and installation of casework items.
- E. Ship and handle all materials and fabricated items in a manner which will prevent damage thereto, and store all materials and fabricated items at a dry, elevated, ventilated, and protected interior location.
- F. Sequence deliveries to avoid delays and to minimize on-site storage.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before, during, and after installation of casework; maintain temperature until Owner's Final Acceptance.
- B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before, during, and after installation of casework: maintain relative humidity until Owner's Final Acceptance.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.8 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturers standard material and workmanship warranty on the work of this Section for a period of 3 years following Date of Substantial Completion.
 - a. Provide 1 year warranty for lock parts

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Manufacture: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Columbia Lockers Division of PSiSC, Columbia, SC Manufacturers offering similar products which may be considered as equal, are limited to the following:
1. Columbia Lockers Division of PSiSC, Columbia, SC.
 2. ASI Storage Solutions, Inc., Memphis, TN.
 3. AccuTec Manufacturing, Santa Ana, CA.

2.2 LOCKERS

- A. Materials: CLASS A fire rated solid phenolic core, color matched with integrally bonded decorative "matte finish" melamine surface manufactured as an integral part of the core material. Laminated surfaces will not be accepted. Surface and edges shall be non-porous and shall not support the development of fungus or bacteria. Exposed surfaces that exhibit discolorations, pitting, seam marks, roller marks, stains, telegraphing of core material, chipping at edges or corners or other imperfections on finished units will be rejected. Solid phenolic shall meet or exceed all requirements for CLASS A Flame Spread Rating and Smoke Developed calculated according to ASTM E84. Certifications shall be in the name of the locker manufacturer and shall be less than six (6) months old.
- B. Locker Types:
1. Solid phenolic single tier wardrobe lockers, mounted on wood curb. Solid phenolic doors with stainless steel hardware.
 - a. Atrium Lockers: 15 inches wide by 12 inches deep by 36 inches high, typically in banks of five.
 - b. Phenolic finish: Match Wisonart laminate color "Raw Chestnut", number 7975, additionally include 3 additional wood grain plastic laminate colors as selected by Architect.
- C. Locker body: Locker body shall incorporate mortise and tenon construction with unitized locker body construction to allow for multiple locker configurations within the same body. Locker body shall be mechanically fastened with stainless steel fasteners. Locker shelves shall be mortised into sidewalls of the body at locations determined by the Architect or as indicated on the Drawings. Relocation of shelves in the field shall be possible without the need for special tools or welders. Hinges shall be attached to the body with stainless steel theft-proof Torx head with pin bolt fasteners. Lockers shall be delivered fully assembled.
1. Locker box tops and bottoms and shelves: 3/8 inch (10 mm) thick fabricated from material as body.
 2. Tops, end panels and toe kick plates: 1/2 inch (13 mm) thick fabricated from material as body.
- D. Locker doors: 1/2 inch (13 mm) thick frameless locker doors shall be the full width of the locker and shall allow access to the entire width of the locker. Framed doors will not be approved. Perimeter ventilation shall be integral to the door

construction. Doors shall be attached to hinges with stainless steel theft-proof Torx head with pin bolt fasteners.

E. Hardware and accessories

1. Locker hasp bar: Fabricated from 11 gauge Type 304 stainless steel with satin finish. All edges shall be polished and smooth. Hasp shall be attached to the body with two (2) stainless steel theft-proof Torx head with pin bolt fasteners or through bolts as recommended by the manufacturer. Hasp shall extend through a slot in the face of the locker door and the locker number plate. Hasp bar accept padlocks furnished by the Owner.
2. Hinges: Concealed, 5 knuckle type constructed from 14 gauge Type 304 stainless steel with satin finish. Hinge shall allow door to open 180°.
3. Coat Hooks: Surface mounted, 11 gauge Type 304 stainless steel with satin finish. All edges shall be polished and smooth. Coat hooks shall be attached to locker body with stainless steel theft-proof Torx head with pin bolt fasteners or through bolts as recommended by the manufacturer. Provide three (3) coat hooks for all lockers.
4. Number Plates: Provide manufacturer's standard number plate for each door in the sequence. Number plate shall be engraved from the back side to prevent the accumulation of dirt and grime.

2.3 FABRICATION

- A. Provide factory pre-assembled locker units. Lockers shall be complete with all hardware and accessories listed above. Knocked down units will not be accepted.
- B. Factory machine attachment holes accurate and free of chips.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Verify that field measurements are as indicated on reviewed and approved shop drawings.
- B. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

- A. Do not commence installation of lockers until immediately adjacent surfaces have been completely installed and finished.
- B. Perform installation work in accordance with the approved shop drawings and the manufacturer's installation instructions.
- C. Set lockers absolutely level and in true line, with units bolted together and to the surrounding partitions, to provide a rigid and secure installation.
 1. Anchor locker units to wall studs through the locker back and to the base through the locker floor. Join side by side lockers by attaching fasteners through pre-drilled holes.

- 2. Conceal screw heads and bolts as far as practicable, leaving locker cabinets completely free from unused bolt holes.
 - D. Furnish and install all trim and filler pieces as required to completely fill recesses, and to align with ends of partitions. Refer to the Drawings for the various conditions.
 - E. Adjust and align doors for uniform spacing after installation of lockers.
 - F. Attach number plates in sequence after lockers are in place.
- 3.3 ADJUSTING AND CLEANING
- A. Test each door and latching device, and make adjustments required to ensure a bind-free operation and proper latching.
 - B. Remove all tape and other packing materials from locker surfaces, and thoroughly clean and polish all exterior and interior surfaces.
- 3.4 PROTECTION
- A. Protect locker finish surfaces and hardware from damage until Owners Final Acceptance.

End of Section

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Section 10 75 00
FLAGPOLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following at canopy:
 - 1. Wall mounted, vertical, aluminum flagpoles where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
 - 2. Aluminum flashing collars.
 - 3. Steel baseplate(s).

1.3 RELATED REQUIREMENTS

- A. Section 03 30 00 - CAST-IN-PLACE CONCRETE: Footing for bollards, and fence.
- B. Division 31 - EARTHWORK.
- C. Division 26 - Electrical.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. NAAMM: Metal Flagpole Manual.
 - 2. NAAMM/ANSI FP 1001: Metal Flagpole Manual.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Materials list of items proposed to be provided under this Section.
 - 2. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties for each item furnished hereunder.
 - 3. Shop drawings: Large scale design details of flagpole assembly including foundation and all accessories.
 - 4. Samples of each item, color and pattern available in the specified grades from the proposed manufacturers.

5. Verification samples: Actual metal sample with applied specified finish
6. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.6 QUALIFICATIONS

- A. Installer, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products are limited to the following:
 1. Concord-American Industries, Inc., Addison TX.
 2. Aabec Pole Div., Morgan-Francis Co., Inc., Rushville IN.
 3. Pole-Tech Company, Inc., E Setauket NY.

2.2 FLAGPOLE

- A. Flagpole: Seamless extruded tubing, aluminum complying with ASTM B241, alloy 6063-T6 heat-treated, age hardened, having a minimum wall thickness of 0.188 inch, tensile strength of not less than 30,000 psi and yield point of 25,000 psi.
 1. Exposed height: 48 feet.
 2. Butt diameter: 10 inches.
 3. Top diameter: 4 inches.
 4. Wall thickness: 0.312 inches.
 5. Maximum Flag Capacity: 8 by 12 feet.
 6. Flagged wind speed (constant): 150 miles per hour.
 7. Pole construction: Manufacturer's standard seamless, uniform, straight-line cone tapered section above a cylindrical butt section.
 8. Pole sections: Fabricate pole in one piece wherever possible. For field joints, use internal splicing sleeve for weather-tight and invisible seams.
- B. Base: Provide manufacturer's standard base and anchorage system (building mounted), including necessary accessories.
 1. Lightning Protection: 3/4 inch diameter, steel lightning protector ground spike welded to base plate and to support plate, minimum 36 inches long.
 2. Flash collar: Aluminum. Finish to match flagpole shaft.
- C. Accessories: Manufacturer's standard to suit size and type of pole, as follows:

1. Finial ball: 5 inch diameter, 14 gage spun aluminum ball.
 2. LED lighting package equal to American-Concord model "Internal Halyard Beacon plus, dual light winch system." Light shall freely rotate towards direction of flag with wind changes.
 3. Halyard - 5/26 inch diameter polypropylene white rope.
 4. Snap hooks - chrome plated bronze, 3-1/3 inch long with swivel eye. Provide two per each halyard.
 5. Counterweight: 3-1/2 inch neoprene coated counter weight and beaded nylon retaining ring.
 6. Cleat cover - cast aluminum. manufacturer's standard.
 7. Cleat - internally mounted cam-action cleat with integral sheeve, factory mounted.
 8. Truck - all aluminum 356 alloy die cast revolving non-fouling truck assembly with body revolving on 1/2 inch stainless steel base in spindle race. Truck to have two 1/2 inch diameter sheaves rotating on 3/8 inch stainless steel pins.
- D. Finishes: Themoset powder coat in metallic finish matching Architect's control sample.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Verify location of anchorage items.
- C. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION - FLAGPOLES

- A. Install flagpole plumb and true, and firmly wedged into building mounting brackets; install accessories, all in accordance with manufacturer's instructions and in compliance with the reviewed and accepted shop drawings. Provide positive lightning ground for each flagpole installation.
- B. The completed installation shall be left free of blemishes and in perfect operating condition.

3.3 CLEANING

- A. Upon completion of the work of this Section remove tools, equipment and all rubbish and debris from the work area; leave area in rake-clean condition.

End of Section

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Section 11 31 00
RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Provide appliances, including the following:
 - 1. Refrigerator.
 - 2. Under-counter dishwasher.
 - 3. Washer.
 - 4. Dryer.
 - 5. Stackable washer and dryer (located at Custodial Storage).
 - 6. Heavy Duty Dryer.
 - 7. Heavy Duty Washer.
 - 8. Range
 - 9. Range hood.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction recycling.
- B. Division 22 – PLUMBING: Hot and cold water supply, and sanitary connections to appliances.
- C. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Exhaust duct connections to appliances.
- D. Division 26 - ELECTRICAL: Electrical supply to appliances.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.

2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer's certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
4. Manufacturer's sample warranties.
5. Shop drawings for coordination: Provide dimensioned locations for utility connections.

- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's warranties: Include coverage of installed equipment.
 2. Maintenance Data: Include lubrication and periodic maintenance requirement schedules.

1.5 REGULATORY REQUIREMENTS

- A. Products requiring electrical connections: Listed and classified by UL, as suitable for the purpose specified and indicated.
- B. Provide and install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

1.6 QUALITY ASSURANCE

- A. Certification labels: Provide residential equipment which complies with standards and bears certification labels as follows:
1. Energy ratings: Provide energy guide labels with energy cost analysis (annual operating costs) and energy information required by Federal Trade Commission.
 2. UL standards: Provide residential equipment with UL labels.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Store all materials in original packaging in protected interior location.
- B. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows or doors to place and install the work of this Section shall be performed at not additional cost to the Owner.

1.8 WARRANTY

- A. Provide manufacturer's standard 2 year warranties under the provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. General Electric Company, (GE) Appliances Division, Louisville KY.,
 2. KitchenAid Company (division of Whirlpool Corp), St. Joseph, MI.
 3. Maytag Company, Magic Chef Division, Cleveland TN.
 4. Frigidaire Corp./ Division of Electrolux Home Products Inc., Martinez, GA.
 5. Scotsman, Vernon Hills IL.
 6. Summit, Bronx, NY
 7. Felix Storch, Inc., Summit Appliance Division, Bronx, NY.
 8. Whirlpool Corporation, Benton Harbor MI.

2.2 EQUIPMENT

- A. General: Without intent to limit competition, but to establish a standard of quality, design and function desired, Drawings and specifications have been based on the models listed below. Equal products are available from the manufacturers listed herein above. Under provisions of Massachusetts General Laws, Chapter 149, equal products not named herein, may be considered for acceptance as an equal by the Architect upon submission of complete product information as described in Section 01 25 13 - PRODUCT SUBSTITUTION PROCEDURES.
1. Dishwasher, under-counter: General Electric Model No. GDF650SSJSS.
 2. Dryer: General Electric Model No. GFDR27EHMC.
 3. Washer: General Electric Model No. GFWR2705HMC.
 4. Heavy Duty Dryer: Speed Queen Model 55lb Tumble Dryer.
 5. Heavy Duty Washer: Speed Queen Model No. SC30.
 6. Range: General Electric Model No. JB750SJSS.
 7. Range hood: General Electric Model No. JV636HSS with Cord Kit JXHC1 and Mfr. Std. dust cover.
 8. Refrigerator (Type 1 at Staff Lunch, and Custodian Break Rooms): General Electric Model No. GSE25HSHSS.
 9. Refrigerator (Type 2, at Science Prep., and Medical): 24 inch width Frigidaire Model No. FFET1222UV.
- B. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories whether specified or not for a complete installation.

2.3 FINISHES

- A. Finish Colors: Provide manufacturer's standard colors as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.
- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

- A. Install each product in accordance with manufacturers' instructions.
 - 1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.
- B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00 - EXECUTION.
- B. Adjust equipment to ensure proper working order and conditions.
- C. Remove and replace equipment creating excessive noise, or vibration.
- D. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.4 CLEANING

- A. Clean Work under provisions of Section 01 73 00 - EXECUTION:
 - 1. Wash and clean appliances.
 - 2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.
- B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

Section 11 40 00
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section. Other Specification Sections that directly relate to work of this Section include, but are not limited to:

1. Section 018113, SUSTAINABLE DESIGN REQUIREMENTS.

1.02 WORK INCLUDED

- A. Attention is directed to the detailed Item Specifications, which provide for minimum acceptable products. Item Specifications paragraphs may indicate materials or components that exceed the manufacturer's standards and are required for this project.
- B. Cooperate and coordinate with others engaged on the project in order that work will progress on schedule.
- C. Work to be performed under this Section is shown on Foodservice Equipment Drawings.
- D. Install materials furnished under this Section, other than materials that are expressly noted for installation under other Sections. Installation work shall be performed by workmen compatible with those existent on the project site. Equipment shall be of the latest design; new and unused, unless indicated otherwise in the Item Specifications, complete with all standard parts for normal operations and including such accessories or materials as may be required to comply with these Specifications.
- E. This Specification is to further describe and supplement the applicable Drawings. What is called for by either the Drawings and/or these Specifications shall be furnished and installed as part of this work. Any questions relative to discrepancies or omissions shall be submitted to the Architect.
- F. Provide neatly punched openings or cutouts required to permit passage of plumbing and electrical services by related trades and to accommodate mounted switches and receptacles in the equipment.
- G. Work in this Section shall include but shall not be limited to the following:
1. Catalog items of equipment.
 2. Fabricated equipment other than catalog items.

3. Plumbing trim consisting of mechanical system components required for standard operation of equipment items such as faucets and waste outlets. Vacuum breakers shall be furnished for equipment where water is introduced less than 2 in. above flood level.
4. Electrical equipment forming an integral part of equipment items such as electric motors, heating elements, controls, switches, starters, temperature regulators and internal wiring to a control panel or switch, if mounted on the equipment.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Finished floor and walls, structural supports for all ceiling supported equipment, acoustical ceilings and related building.
- B. Connecting piping, waste lines, traps and vent piping, complete with shut-off valves to all the equipment, and the rough-in for sanitary waste, domestic water, floor drains and plumbing fixtures except those provided under this Section, and related mechanical work.
- C. Exhaust ventilating systems complete with blowers, ductwork, hangers, access panels, and insulation between the exhaust collars and the exhaust blowers.
- D. External wiring; the mounting and wiring of motor starters, solenoid valves, switches and receptacles not integral with the equipment; mounting and wiring of walk-in refrigerated room ceiling mount light fixtures; wiring of walk-in refrigerated room interior evaporator coils; connecting conduit, and external connections to equipment to the building electrical distribution system.

1.04 SUBMITTALS

- A. Submit Shop Drawings for approval in accordance with the General Conditions.
- B. Stub-in drawings shall indicate the layout of equipment and dimensioned locations of all services to the equipment.
 1. CAD drawn scale: 1/4 in. = 1 ft., 0 in.
 2. Stubbed services shall include electrical, hot and cold water, floor drains or floor sinks, solid wastes and exhaust collar connections. Point of connection services shall include steam supply, condensate return, gas connection and indirect waste connections. Service dimensions shall include height measured from finish floor.
 3. Electrical and plumbing services shall be indicated and coordinated on the same drawing.
 4. Call-outs for each stub point indicated at the point, or clearly keyed to a schedule on the same drawing.
 5. Special conditions plan shall include all floor recesses, curbs and special wall construction indicated and dimensioned

- C. Fabrication drawings shall be furnished for non-catalog items, showing plans, elevations and full construction details with gauges, components, fasteners, erection and connections. Drawings shall be to the minimum scale of 3/4 in. = 1 ft., 0 in.
- D. Standard items of equipment, not built-in or part of other assemblies shall be submitted for approval in the form of bound catalog cuts. Each cut shall include a clearly marked item number, a listing of all optional accessories and finishes, and connection data.
- E. Catalog Cuts shall include letters of approval, under a separate binder, indicating compliance with M.G.L. c. 142 and 248 CMR. Only products and materials that have been listed by the Board as Product-approved shall be used for plumbing and gas fitting work performed in the Commonwealth of Massachusetts.
- F. Mechanical refrigeration system submittal shall include the firm name and address of the installation contractor and name of the qualified installer.
- G. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible. Kitchen Equipment Contractor shall clearly indicate that items are Energy Star rated both on the submittal cover sheet and manufacturer cut sheets.
- H. Failure to comply with approved shop drawings shall be cause for rejection of an improperly built assembly.

1.05 SAMPLES

- A. If the bidder's proposed equipment fabricator is unknown to the Consultant's office, immediately after award of contract, submit the following samples for selection and approval:
 - 1. Section of table showing edge, bullnose, framing, fasteners, gusset, leg, and foot, all assembled.
 - 2. Drawer assembly (will be returned for use on this project).
- B. Work delivered to the job shall match approved samples.

1.06 GUARANTEES AND WARRANTIES

- A. New equipment furnished for this facility shall be guaranteed for a period of not less than one calendar year beginning on the date of final acceptance of the work of this Section. In the case of a manufacturer whose standard warranty exceeds this period the longer period shall apply. Self-contained refrigeration units for reach-in refrigerators, freezers, ice cream chests and ice machines shall carry a five-year replacement warranty for the sealed unit. The guarantee shall protect against defective material, design and workmanship.
- B. In addition to the guarantee called for under the General Conditions, this Contractor shall further agree that in the event of failure of any system or item of equipment or improper functioning of specified work during the guarantee period, he shall have "on call" competent service personnel available to make the necessary repairs or replacements of specified work promptly at no cost to the Owner. In the event that replacement of an entire item is

required, the Owner shall have the option of full use of the defective equipment until a replacement has been delivered and completely installed.

- C. Furnish manufacturer's warranties for each item of standard equipment and a warranty on fabricated equipment. Submit guarantees and warranties to the Architect in accordance with conditions found in "Demonstration and Operating Instructions" paragraphs, contained in Part 3, this Section.

1.07 REGULATORY AGENCIES

- A. Work shall be in accordance with the governing health, building and safety, and fire protection codes and regulations.
- B. Standards of the National Sanitation Foundation (NSF) shall serve as guidelines for the work of this Section.
- C. Electric equipment and accessories shall conform to the standards of the National Electric Manufacturers Association (NEMA), Underwriters Laboratories, Inc. (UL) or Electrical Testing Station (ETS).
- D. Steam generating equipment and accessories shall conform to the standards of the American Society of Mechanical Engineers (ASME).
- E. Gas fired equipment and accessories shall conform to the standards of the American Gas Association (AGA) and the American National Standards Institute (ANSI) Z83.11.
- F. Energy Star - Specified Energy Star rated equipment and appliances shall serve as the standard for all types of equipment and appliances whenever possible.
- G. BOARD OF STATE EXAMINERS OF PLUMBERS AND GAS FITTERS
Board Required Product-approval. Only products and materials that have been listed by the Board as Product-approved shall be used for plumbing and gas-fitting work performed in the Commonwealth and governed by M.G.L. c. 142 and 248 CMR.

1.08 EQUALITY OF MATERIALS AND EQUIPMENT

- A. The words "or equal" are understood to follow the name of any maker, vendor, or proprietary product, any trade name, plate or catalog number, and any detailed description used in the plans or specifications to define the material, article, assembly or system required. An item shall be considered equal to an item named or described in the plans or specifications if in the opinion of the Architect, it is at least equal in quality, durability, appearance, strength and design, it will perform at least equally the function imposed by the general design for the work, it conforms substantially, even with deviations, to the detailed requirements for the item in the plans and specifications, and it does not result in increased cost to the Owner. The words "or equal" shall not be construed to permit substantial departure from the detailed requirements of the plans and specifications for any material, article, assembly or system, or of any component parts hereof. Procedures for determining whether an item complies with the standards of this paragraph shall be those set forth in the Supplementary General Conditions amending AIA Document A-201.

PART 2 - PRODUCTS

2.01 MATERIALS AND FINISHES

A. General

1. Metals shall be free from defects impairing strength, durability or appearance, made of new materials with structural properties to withstand strains and stresses to which normally subject.
2. Stock materials, patterns, products and methods of fabrication shall be approved provided that they conform to the requirements specified under Item Specifications.

B. Stainless Steel

1. Stainless steel shall be non-magnetic corrosion resistant chromium-nickel steel, Type 302 or 304 (18-8 Alloy), polished to a Number 4 finish where exposed, unless otherwise noted. Minimum gauges shall be as specified under Item Specifications.

C. Galvanized (Galvannealed) Steel

1. Galvannealed steel shall be commercial quality with tight coat of zinc galvanizing metal applied to a soft steel sheet, subsequently passed through a 1200 degree F. oven, resulting in a spangle free paintable surface. Minimum gauges shall be as specified under Item Specifications.

D. Plastic Laminate Materials

1. The laminate facing shall be GP-50, .050 in. thick, general purpose, high pressure, decorative plastic laminate that meets or exceeds the requirements of NEMA Publication LD3-1985, and NSF Standard 35. The plastic laminate exposed surfaces shall be provided in accordance with the specified manufacturer, finish and color. Balancing sheet shall be backing grade GP-28 in matching color at semi-exposed and BK-20 unfinished where hidden.
2. Plastic laminate covered surfaces shall be factory fabricated with 3/4 in. thick core having plastic laminate facing on both faces and all edges, laminated with waterproof glue under pressure in accordance with the plastic laminate manufacturer's specifications.
3. The core shall be medium density phenolic resin particleboard conforming to ANSI A208.1, Type 2-M-2, 45 pound per cubic foot density minimum.
4. Provide veneer core plywood or solid hardwood edge banding for doors and vertical dividers or panels where hardware is attached to casework.
5. Hinges shall be articulated, spring loaded type equal to Grass CST65-170-F or Stanley, with quantity adequate to support the door without deformation. Do not provide handles on plastic laminate clad doors.

2.02 CONSTRUCTION

A. General

1. Flat metal work items of equipment, such as tables, sinks, or counter tops, and other non-catalog items described under Item Specifications, shall be manufactured by a food service equipment fabricator who has the plant, personnel and engineering facilities to properly design, detail and manufacture high quality food service equipment.
2. The equipment fabricator shall be subject to the approval of the Architect, Owner and Consultant. Refer to Paragraph 1.05, Samples.
3. Fabricated foodservice equipment shall be manufactured by one manufacturer, of uniform design, material and finish.
4. Equipment shall conform to the applicable requirements of current Federal, State, and Local Codes and Regulations.

B. Welding

1. The words "weld", "welded" or "welding" as used in this Section of the Specification shall mean that metal joints shall be continuously welded and the exposed parts ground smooth and polished to match adjoining surfaces. Welding electrodes shall match the material being welded.
2. Where spot welding is specified, the welds shall be a maximum spacing of 3 in. on center.
3. Where tack welding is specified, the pieces welded shall have 1/2 in. minimum lengths of welding material at 4 in. on center maximum spacing.

C. Grinding, Polishing and Finishing

1. Exposed welding joints shall be ground flush with the adjoining material and neatly finished to harmonize therewith. Wherever material has been depressed or sunken by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surfaces and, if necessary, again welded and ground to eliminate low spots. Ground surfaces shall be polished or buffed to a degree consistent with good workmanship. Coves shall be ground and polished to match adjoining material.
2. Care shall be exercised in grinding operations to avoid excessive heating of metal and discoloration. Abrasives, wheels, and belts used in grinding stainless steel shall be iron free and shall have not been used on carbon steel. The texture of the final polishing operation shall be uniform and smooth. Grain direction shall be uniform, uni-directional for a total length of material. Cross grains and random polishing are not acceptable.
3. The general finish of equipment shall be consistent throughout the job. Brake ends shall be free of open texture or orange peel appearance, and where brake work mars the uniform finish of the material, the marks shall be removed by grinding and

polishing, and finishing. Sheared edges shall be free of burrs, projections or fins to eliminate all danger of laceration. Mitered or bullnosed corners shall be neatly finished with the underedge of the material neatly ground to a uniform condition and in no case will overlapping material be acceptable. The equipment surfaces, where exposed, shall be finished to a grained Number 4 (satin) finish unless otherwise specified. An exposed surface shall include an inside surface, which is exposed to view when a swinging or sliding door is opened. Underside of shelves need not be satin finish unless otherwise specified.

4. Excessive distortion caused by welding shall be cause for rejection for that item of equipment.

2.03 BUY-OUT COMPONENTS

- A. CASTERS: 5 in. diameter polyurethane tired, swivel, plate or stem mount to suit application, 300 pound capacity, brakes only if specified, NSF approved; Component Hardware C-21-3050 (plate/no brake), C21-3051 (plate/brake) C23-3350 (stem/no brake) or C23-3351 (stem/brake), or equal.
- B. COUNTER LEGS: Stainless steel, 6 in. to 7-3/4 in. height adjustment; Component Hardware A72-0811, or A77-5048, or equal.
- C. DOOR AND DRAWER PULLS: Stainless steel, full grip type with beveled edge, NSF approved for stud mounting in device, in horizontal attitude to meet NSF requirements; Component Hardware P63-1012, or equal.
- D. DOOR HINGES: Stainless steel, lift off type, swedged knuckle for minimum clearance, nylon bearings; Component Hardware M75-1002.
- E. DRAWER PANS: Molded plastic or fiberglass, 20 in. by 20 in. by 5 in. deep, NSF approved; Component Hardware S80-2020, or equal.
- F. DRAWER SLIDES: Stainless steel, NSF approved, full extension, 200 pound capacity with stainless steel ball bearing wheels; Component Hardware S-52 series, or equal.
- G. FAUCET SETS, DECK MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on swivel nozzle or swivel gooseneck to suit the application; T&S Brass B-0221 or B-0321, or equal by Component Hardware, Chicago, or Fisher.
- H. FAUCET SETS, POTWASHING SINK: Chrome plated cast bronze with removable cartridges, 3/4 in. passages, eccentric flanged female inlets on 8 in. centers with LL street EL inlets with locknuts, four prong handles, 12 in. swing spout; T&S Brass B-290.
- I. FAUCET SETS, SPLASH MOUNTED: Chrome plated cast bronze with 1/2 in. IPS eccentric flanged female inlets on 8 in. centers, removable cartridges, lever handles, and aerator tip on 12 in. swing spout; T&S Brass, B-0231 or equal by Component Hardware, Chicago, or Fisher. Provide each with a mounting kit.
- J. GUSSETS: Stainless steel, stepped side, fully closed, NSF approved, mild steel interior reinforcement, wide flange for welding to framing, set screw anchor for leg; Component Hardware A20-0206C, or equal.

- K. LEG AND BULLET FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-6272-C, or equal.
 - L. LEG AND FLANGED FOOT ASSEMBLIES: Stainless steel tubing, 16 gauge, number 4 finish, adjustable bullet foot with 3-1/2 in. diameter flange and two holes for securing to floor, minimum of 3 in. vertical travel, 2,000 pound capacity, top designed for mounting in gusset, length to suit application; Component Hardware A46-4272-C, or equal.
 - M. NUTS: Zinc plated "Pal Nuts" with integral cap and lockwasher; Component Hardware Q-34-1024 or equal.
 - N. SEALANT: Silicone type sealant for sealing equipment to walls or filling crevices between components, TRANSLUCENT, NSF approved; Component Hardware M90-1010, or Dow Corning 732-RTV.
 - O. SOUND DEADENING BASINS: Component Hardware Q75-1366
 - P. SOUND DEADENING TOPS AND SHELVES: Component Hardware Q85-5225 "Tacky Tape" installed between all channel or angle reinforced tops, drainboards or undershelves.
 - Q. WASTE OUTLETS, CRUMB CUP: Stainless steel body, removable crumb cup stopper, gasket, coupling nut and sealing washer, 1-1/2 in. IPS, and optional 4 in. long nickel plated brass tailpiece with gasket; Component Hardware E38-1010, or equal.
 - R. WASTE OUTLETS, LEVER OPERATED: Cast stainless steel rotary type with 1-1/2 in. NPS and 2 in. NPS threads, and removable beehive crumb-cup; Component Hardware DSS-8000.
 - S. WELD STUDS: Copper flashed steel with 10-24 threads, length to suit; Component Hardware Q-36, or equal.
 - T. GFCI RECEPTACLES: Pass & Seymour 2095-W, 115 volt, 20 amp GFCI Duplex Receptacle or equal.
- 2.04 FABRICATED COMPONENTS
- A. Box Type Cabinet Construction
 - 1. Sheet metal cabinet bases of box type construction shall be fabricated without general interior framing. Structural strength shall be achieved by the gauge of the metal and the formed angle and channel edges and corners. Vertical sections shall be closed. Cabinet base shall be fabricated of 18 gauge minimum of material specified at Item Specifications. Mount on counter legs or base as specified.
 - 2. Intermediate shelf shall be fabricated of 16 gauge stainless steel with rear and sides turned up 1-1/2 in. tight to the cabinet sides. The front edge of shelf shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees and shelf spot welded in place. Reinforce underside with longitudinal 14 gauge channel on the centerline.
 - 3. Bottom shelf shall be fabricated of 16 gauge stainless steel similar to the intermediate shelf except that the front edge shall be formed into a full width 1-1/2 in. by 4 in.

welded in boxed channel. Rear edge shall be fitted with a full width channel. Underside shall be reinforced.

B. Counters and Drainboards

1. Counters, table tops and drainboards shall be 14 gauge stainless steel, of NSF construction, with edges per Item Specifications. Metal tops shall be made of the largest pieces available and shall appear as one piece with all field and shop joints reinforced and welded, ground and polished. Short pieces of metal will not be acceptable. Counter bends shall be not less than 1/8 in. radius. Wherever a fixture has a waste or drain outlet, the surface shall pitch toward the outlet.
2. Counters, table tops and drainboards shall be reinforced with channel or angle frame as specified in the Item Specifications. Framing shall be secured to the underside with sound deadening material sandwiched between the surfaces, weld studs, and nuts.
3. Wherever bolts or screws are welded to the underside of trim or tops, neatly finish the reverse side of the weld uniform with the adjoining surface of the trim or top. Depressions at these points will not be acceptable. Raise dimples and depressions by peening, or heating and shrinking, and grind and polish to present a flat surface.

C. Crossrails

1. Crossrails shall be not less than 1-1/4 in. outside diameter 16 gauge stainless steel tubing welded, ground and polished to a Number 4 finish. Crossrails shall be welded to legs at a height of 10 in. above finished floor, and shall extend from left to right between front legs, unless otherwise specified, and from front to back between all legs.

D. Drawer Assembly

1. Drawer assemblies shall consist of a removable drawer pan set in a removable 16 gauge stainless steel channel shaped drawer support frame with gusset plate reinforced corners.
2. Support frame shall have double pan front cover consisting of boxed 18 gauge stainless steel outer shell with welded corners, flush mounted recessed stainless steel pull, 20 gauge stainless steel back shell tack welded to outer shell with fiberglass sound deadening between. Drawer shall be provided with rubber bumpers to quiet closing. Support drawer frame on full extension drawer slides.

3. Drawer shall be suspended from table in a three-sided, 16 gauge stainless steel enclosure with flanged-in bottom edges, banded lower front, flanged-out front side and top edges. All sharp corners shall be broken and any exposed exterior threads of slide mounting bolts shall be provided with solid metal acorn nuts.
4. Component Hardware S91-0020 with thermoplastic pan is considered as equivalent to the above specified construction.

E. Edges

1. Marine: Bumped up 1/2 in. at 45 degrees and turned down 1-1/2 in. and in 1/2 in. at 45 degrees; corners welded and square.
2. Raised roll: Coved up and rolled 180 degrees on a 1-1/2 in. diameter with 3 in. height; corners welded and rounded or coved.
3. Rolled: Rolled 180 degrees on a 1-1/2 in. diameter; corners welded and bullnosed.
4. Short (6 in.) splash on counters and tables: Coved up 6 in., turned back to wall or equipment 1 in. and down 1/2 in.; ends welded closed. Secure tight to face of wall with clips unless specified otherwise and seal joint.
5. Tall (10 in.) splash on preparation sinks, dishtables, counter, and tables: Coved up 8-1/2 in., turned back to wall or equipment 1-1/2 in. at 45 degrees and down 1/2 in.; ends welded closed. Secure 3 in. off face of wall with brackets unless specified otherwise.
6. Turn down: Turn down 2 in. and in 1/2 in. at 45 degrees; corners welded and square.

F. Framing of Tops, Drainboards, Undershelves

1. Channel: Reinforce with 1 in. by 4 in. by 1 in. 14 gauge galvannnealed steel channels; stainless steel if exposed to view. Channels shall run front-to-back at all legs and longitudinally on the centerline. Cross and longitudinal members shall be welded into a single assembly at intersections and sharp corners shall be broken. Framing shall be secured to underside of tops with pairs of weld studs. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. The following specified angle framing is considered superior to channel framing and may be used in its place.
2. Angle: 1-1/2 in. by 1-1/2 in. by 1/8 in. perimeter angle frame with crossmembers not over 30 in. on center. Framing shall be secured to top with weld studs, 18 in. on center maximum with three minimum studs on any single face of a table. Perimeter angle frame that is exposed to normal view, shall be stainless steel. Crossmembers and framing not unexposed to normal view shall be iron. Corners of angle frame shall be mitered, or notched and brake formed to form a closed corner. Corner gusset plates used for mounting of leg gussets shall be 1/8 in. thick and sealed to underside of the top. Iron framework joints shall be ground smooth, and shall be painted with a minimum of two coats of aluminum lacquer after degreasing. Framing shall be installed maintaining NSF required clearance to adjacent vertical surfaces and edges of top. Channel framing shall not be considered equal to specified angle framing.

3. Sound deaden all horizontal framed surfaces with material sandwiched between the framing and the bottom of the surface.

G. Hinged Doors

1. Hinged doors shall be double pan type stainless steel construction with 18 gauge exterior and 20 gauge interior, welded corners, and 1/2 in. fiberglass insulation for sound deadening. Each door shall be provided with a stainless steel recessed handle, and an adjustable tension door catch equal to Component Hardware M22-2430. Doors shall close against the bottom shelf and flush with body of equipment.
2. Louvered hinged doors for ventilation shall be fabricated of the same components and provided with a full perimeter 3 in. wide channel reinforcing frame on the interior face. Remaining face shall be die punched with drip-proof louvers fully utilizing the remaining flat metal or a stainless steel flattened expanded metal grille per Item Specifications.

H. Sinks and Sink Inserts

1. Unless otherwise specified, sinks including sink inserts built into tops of fixtures, shall be made of 14 gauge stainless steel with all vertical and horizontal corners rounded to a radius of approximately 3/4 in. with the intersections meeting in a spherical section. Sinks shall be integrally welded to fixture tops.
2. Sinks with two or more compartments shall have full height, 1 in. thick double wall partitions consisting of two pieces of stainless steel back-to-back so fabricated that each compartment will be a deep bowl with coved corners. Partitions shall be welded in place to the bottom, front and back of the sink with smooth rounded coved corners. Top edges of the partitions shall be continuously welded. The front of the sinks shall consist of a stainless steel smooth, flush apron, same gauge as the sinks. Bottom and rear of partitions shall be closed. Sink dimensions contained in Item Specifications are inside dimensions.
3. Sinks shall be provided with integral 14 gauge stainless steel drainboards when specified. Drainboards and sink basins shall be pitched toward waste outlets and shall be self draining. The underside of all sink basins shall sound deadened. Sink units shall be provided with an integral splash at walls. Provide the necessary holes for the mounting of faucet sets.

I. Undershelves

1. Undershelf in an open type table shall be 16 gauge stainless steel unless otherwise noted. Edges shall be turned down 1-1/2 in. and in 1/2 in. at 45 degrees with corners notched out to fit legs to which shelf shall be welded from underside. Line up all edges of shelf with centerline of legs. Reinforce underside with longitudinal 14 gauge channel on the centerline.

J. Wall Brackets

1. Dish tables, sinks and counters with sinks shall be securely anchored 3 in. off the face of the wall unless specified otherwise. Brackets shall be "Z" shaped and fabricated of 3 in. wide, 14 gauge stainless steel. Brackets shall be secured in a vertical attitude to the rear of equipment backsplash with weld studs, and to the wall with appropriate fasteners.
2. Counters that are specified tight-to-wall shall be secured in a hidden manner with steel clips, and the wall/fixture joint shall be sealed.

K. Wall Shelves

1. Wall shelves shall be fabricated of 16 gauge stainless steel, size per Item Specifications, with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45 degrees. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30 degrees, measured from horizontal.

2.05 ELECTRICAL EQUIPMENT AND WIRING

- A. Under this Section, items of equipment having mounted electrical motors, electrical heating units, lighting fixtures, controllers, control stations, switches, receptacles and the like shall be internally wired as specified herein, terminating at a junction box mounted on the equipment and left ready for connection to the building electrical distribution system by the Electrical Contractor. Extra ceiling mount light fixtures for refrigerated rooms shall be delivered to Electrical Contractor for field installation and wiring. Connections to evaporator coils mounted inside refrigerated rooms shall be wired by the Electrical Contractor.
- B. Provide openings or cutouts required to accommodate the switches and receptacles in the specified work, and the wiring in conduit from terminal blocks in junction boxes.
- C. Electrically operated equipment and fabricator wiring shall conform to the requirements of Underwriter's Laboratories, Inc. Motors over one horsepower shall be equipped with overload protection.
- D. Furnish wiring diagrams for equipment as requested by the Architect or Contractor.

2.06 ITEM SPECIFICATIONS

Item 01

MOP SINK AND FAUCET

No work in this Section. Item to be provided and installed by Plumbing Subcontractor.

Item 02

UTILITY SHELF

Make - Advance Tabco K-245 or equal by Eagle or IMC Teddy

Size - 24 in. by 8 in. by 7-1/2 in. high

Description - Unit shall be all standard construction of welded 18 gauge stainless steel type 430 polished satin finish, back and sides turned up 1-1/2 in., mounted on two die formed wall brackets and furnished with two mop hangers and three rag hooks.

Item 03

MOP BUCKET

No work in this Section. Item to be provided by Owner.

Item 04

DETERGENT STORAGE CABINET

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 36 in. by 18 in. by 72 in. high

Construction - 16 gauge stainless steel top with edges turned down, 18 gauge stainless steel cabinet body, fixed bottom shelf, three adjustable intermediate shelves, and 63 in. high double pan hinged doors at front. Mount on 6 in. high stainless steel adjustable legs.

Accessories - Provide unit with two (2) three point "T" handles, one locking and barrel bolts mounted to inside top and bottom of door. Provide slotted "L" bracket a top rear for securing to wall.

Item 05

LOCKERS

Quantity - 3

No work in this Section. Item to be provided and installed by General Contractor.

Item 06

Spare number

Item 07

Spare number

Item 08

WALK-IN COOLER

Make - American Panel, Bally, or ThermalRite

Size - 10 ft., 1 in., by 8 ft., 7 in., by 7 ft., 10 in., high minimum inside dimensions; 7 ft., 8 in., high after finished floor is installed by the General Contractor

Power - 1.1 KW - 120/60/1 to light fixtures, temperature monitor/alarm, and door defrost heater strip

Installation, Construction, Materials and Accessories - See Item 09

Guarantee - See Item 09

Item 08a

MECHANICAL REFRIGERATION SYSTEMS (COOLER EVAPORATOR COIL)

Make - Bally, Keeprite, Heatcraft, or Trenton

Scope - Furnish and install complete refrigeration systems for the walk-in refrigerated rooms in accordance with the plans. The systems shall include condensing units, evaporator coils, piping, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted refrigeration practice.

Important: The installation work shall be performed by a fully qualified refrigeration contractor employing a certified mechanic fully trained in the installation of commercial refrigeration systems. Submittal shall list the installing company and the qualified system installer.

Piping - Furnish and install the interconnecting piping between the condensing units and their respective unit coolers. Piping shall be installed in a neat and workmanlike manner with adjustable hangers spaced at no more than ten foot intervals on horizontal runs; six foot intervals, vertical runs.

Line sizes shall be in accordance with ASHRAE standards and best refrigeration practice to assure proper feed to evaporator, avoid excessive pressure drop, and prevent excessive amounts of lubricating oil from being trapped in any part of the system. Line sizing shall be such that it will protect the compressor from loss of lubrication at all times, prevent liquid refrigerant from entering the compressor during operating or idle time, and maintain a clean and dry system.

Refrigeration piping shall be Type L, ACR grade, hard drawn seamless copper tubing, wrought type copper fittings, and silver soldered joints. Precharged lines are not acceptable.

Furnish and install sleeves for refrigerant and evaporator drain piping wherever piping passes through a wall or ceiling. Sleeves shall be non-conductive gray plastic tubing, with interior dimension sized at least 1/4 in. larger than piping, and shall be neatly packed with brine putty after installation.

Furnish and install condensate drain piping from the unit cooler to an open drain. Piping shall consist of not less than 7/8 in. Type L copper tubing, supported 36 in. on center maximum, in such a way that there will be 1 in. clearance between the wall and the tubing. Provide a union or slip fitting at the connection to the evaporator drain pan to allow easy disassembly for service and cleaning. Drain piping shall be pitched 4 in. to the foot and carried through the wall of the refrigerated area. It shall be trapped to prevent entry of warm air and insects to the refrigerated rooms and discharged to a floor drain with the code required air gap. The exposed drain piping shall be spray painted.

Provide an electric drainline heater tape in the freezer, with a length equal to five wraps per foot of length of the drainline located within the freezer compartment. Wrap and secure in accordance with manufacturer's recommendations.

Provide chrome plated escutcheon plates at all exposed points where piping penetrates the wall or ceilings.

Insulation - Suction lines for refrigerated rooms having a temperature above freezing shall be covered with 3/4 in. wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

Suction lines for refrigerated rooms having a temperature below freezing shall be covered with 1 in. wall thickness closed cell HT Armaflex insulation with ultra violet radiation protection.

The insulation shall be applied to these lines in accordance with manufacturer's recommendations, and as they are being installed so that insulation will not be split. All joints shall be completely sealed with overlapping, cemented material to prevent the formation of frost on the lines.

Controls - Each evaporator shall be provided with a Smart-Vap II electronic control as manufactured by National Refrigeration. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

Refrigerant Testing - The entire system shall be pressure and leak tested at no less than 100 PSIG, cleaned and dehydrated by maintaining a vacuum of 500 microns or lower for a period of five hours. The required operating charge of refrigerant and oil, if necessary, shall be added and the entire system tested for performance. Each system shall be clearly marked as to the type refrigerant required.

Guarantee - The equipment shall be guaranteed to maintain the specified temperatures. All mechanical refrigeration equipment shall be mechanically guaranteed for a period of one year after date of acceptance by the Owner. The emergency service shall be provided free of charge, whenever necessary on a 24 hour, seven day-per-week basis during the guarantee period.

Any leaks that occur during the first year of operation after acceptance by the Owner, shall be repaired and the necessary refrigerant added at no expense to the Owner.

The year's service shall be provided by the installing company, and under no circumstances will the service policy be sublet to another refrigeration contractor. The name of the installer/service agency for the guarantee period shall be located at a prominent place on the condensing units.

The condensing units shall be provided with an additional four year parts warranty to commence upon the completion of the aforementioned guarantee, bringing the total parts warranty to five years.

Condensing Units - The condensing units shall consist of an EC energy saving motor with variable speed controller, compressor, refrigerant condenser, liquid receiver, compressor service valves, and a dual high-low pressure control. The units shall be as manufactured by National Refrigeration.

The condensing units shall be outdoor type, wall mountable, and quiet type with an approximate 53 to 61 decibel rating at 100 percent fan speed. The compressor shall be serviceable semi-hermetic or scroll type per schedule, and fitted with gold coated aluminum fin condenser, suction service valve, discharge service valve, compressor contactor, high and low pressure controls, receiver with fusible plug, liquid shut-off valve and charging port, mounted non-fused disconnect switch, waterproof electrical control box, discharge line vibration eliminator, weather resistant enameled galvanized steel cabinet, access guard, liquid line assembly, suction line filter and vibration eliminator, crankcase heater, and 1-1/2" high raised steel base. Provide each unit with a low ambient kit with heated and insulated receiver and a TD relay.

Mount on a concrete pad provided by the General Contractor per architectural drawings with building penetrations and weatherproofing provided by the General Contractor.

Evaporator Coils - Each evaporator shall be provided with a Smart-Vap II electronic control, as manufactured by National Refrigeration, thermostatic expansion valve, and solenoid valve. The time clock and heater contactor shall be removed from the condensing unit. No control wiring will be required from evaporator to the condensing unit.

The freezer shall be provided with an automatic electric defrost system consisting of one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with variable speed EC energy saving fan motors with controller. Coil shall be NSF and UL Listed.

The cooler shall be provided with one evaporator coil as indicated in the schedule. Evaporator shall be low profile type six fins per inch complete with EC energy saving fan motors. Coil shall be NSF and UL Listed.

Furnish and install 1/4 in. minimum diameter stainless steel threaded mounting rods for the hanging of the evaporator coils, with stainless steel washers and nuts on the interior ends, and reinforcing angle at the exterior top of the room. Plated steel running thread is not acceptable.

Refrigeration Equipment Schedule

Cooler Room Temp: +35°F		TD: 10°F			
Condensing unit	Amps	Ref	BTU/hour	Evap Temp	Cond Temp
BQZA007H8-HT3A	6.5 - 208/3	448a	7,875	+25.4°F	+95°F
Evaporator coil	BTU/hour	CFM	Fan amps	Defrost amps	Defrost type
BLP209MA-S1B-T	7,875	2,020	2.0 - 120/1	NA	Timed ambient
Freezer Room Temp: -10°F		TD: 10°F			
Condensing unit	Amps	Ref	BTU/hour	Evap Temp	Cond Temp
BQZA020L8-HT3A	11 - 208/3	448a	7,022	-20.5°F	+95°F
Evaporator coil	BTU/hour	CFM	Fan amps	Defrost amps	Defrost type
BLP207LE-S2B-T	7,022	2,020	1.2 - 120/1	8.2 - 208/1	Timed ambient

Item 08b
 COOLER CONDENSING UNIT
 Part of item 08a

Item 09

WALK-IN FREEZER

Make - American Panel, Bally, or ThermalRite

Size - 7 ft., 4 in., by 8 ft., 7 in., by 7 ft., 10 in, high minimum inside dimensions; 7 in., 8 in., high after finished floor is installed by the General Contractor

Power - 1.3 KW - 120/60/1 to light fixtures, temperature monitor/alarm, door defrost heater strip, and pressure relief port

Installation - The walk-in refrigerated room shall be installed in a 7 in., deep ID recess (below finished floor). Recess depth allows 1 in. for use of leveling sand; 4 in., for the insulated floor panels; 2 in. for finished floor and setting bed that shall be carried in from the adjacent room and level to same. The finished floor and setting bed shall be furnished and installed by the General Contractor, and shall have coved joints at all walls, turned up a minimum of 4 in. inside and out. The unit shall be set level on a bed of clean, dry mason's sand. Shims are not acceptable for leveling material.

Construction - All standard construction per the manufacturer, modified to meet the specific following points:

- Walls to be 4 in. thick with CFC free urethane foam insulation, UL Class 1 rated
- Cam type locking devices
- 34 in. by 76 in. minimum door clearance
- Polished hardware (hinges and latch to match)
- Three hinges on doors (to include one Kason 1248 spring assist hinge per door)
- Leveraged pull handle (mechanical advantage type, Kason 1236 or equal)
- Quarter turn inside safety release lever handle mechanism (not screw type)
- Prewired door sections with heater wires and light fixtures and switches
- Kason 1808 LED light fixtures (electrical conduit ran above cooler box)
- Dial type thermometers at doors
- Model IC+ (with dry contacts) or Modularm 75LC temperature and HACCP monitoring system at doors.
- NSF construction throughout with exception of buried floor panels
- Interior and exterior faces of doors and exposed walls shall be provided with aluminum diamond tread plate protective material to a height of 48 in. above finished floor. Hold diamond plating up 6in. from the finish floor to accommodate the coved base.

Minimum materials - Interior and exterior wall surfaces shall be clad with .038 in. pebble finished aluminum. The ceiling shall be finished in white polyester over 24 gauge galvanized steel. Interior floor shall be 14 gauge galvanized steel.

Accessories - Freezer shall be provided with an electrically heated pressure relief port. Each door shall be provided with a heated vision panel, 14 in. by 14 in., constructed of three panels of tempered unbreakable glass, electrically heated, with sealed air spaces between. Provide matching trim strips and closure panels to adjoining surfaces, fabricated per details, made of largest pieces available to minimize number of joints, and installed in accordance with NSF Brochure 770202, Installation Manual for Walk-in Refrigerators and Freezers. Provide four total extra Kason 1808 LED light fixtures for mounting in the rooms and deliver to Electrical Contractor for field installation.

Guarantee - The walk-in refrigerated room panels shall be guaranteed for a period of ten (10) years from the date of approved installation for defects in materials and workmanship when subjected to normal use and service; remainder of rooms for one year.

Item 09a

FREEZER EVAPORATOR COIL

Part of item 08a

Item 09b
FREEZER CONDENSING UNIT
Part of item 08a

Item 10
MOBILE DUNNAGE RACKS
Quantity - 4
Make - Channel MD2036CA/052 or equal by Kelmax or New Age
Size - 36 in. by 20 in.

Description - Dunnage platforms shall be all standard construction with 1-1/2 in. by 1-1/2 in. by .070 in. thick wall extruded Type 6063-T5 aluminum tubing with five lateral tubes and heavy duty plate mounted 5 in. by 2 in. polyurethane casters with unit capable of supporting 2,000 pounds.

Accessories - All casters shall swivel. Provide each with an H24 push handle.

Item 11
WALK-IN COOLER SHELVING
Quantity - 7

Make - MetroMax Q or equal by Eagle or Cambro

Size - (4) 48 in. by 21 in. and (3) 36 in. by 21 in., all 69 in., high on casters; four tier

Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5 in. diameter polyurethane tired swivel casters with donut bumpers.

Accessories - Provide with polymer posts in lieu of standard.

Item 12
MOBILE PAN RACK
Quantity - 4
Make - New Age 1332 or equal by Channel or Piper
Size - 20-1/2 in. by 26 in. by 69 in. high
Capacity - Fifteen 18 in. by 26 in. pans on 4 in. centers

Description - Rack shall be fabricated of welded extruded aluminum 1 in. by 1 in. by .070 in. tubular uprights and framing, and 1-1/4 in. by 1-5/8 in. by .100 in. angle pan slides with corners chamfered and deburred. Gussets of 1-1/2 in. by 1-1/2 in. by 5/8 in. angle aluminum shall be welded to the bottom inside angles where horizontal bracing meets vertical uprights. Mount on platform type, 5 in. polyurethane tired swivel casters.

Item 13
Spare number

Item 14
DRY STORAGE SHELVING
Quantity - 6

Make - Metro Super Adjustable Super Erecta or equal by Eagle or Nexel

Size - (1) 54 in., by 21 in., (1) 48 in., by 21 in., (2) 42 in. by 21 in., (1) 36 in. by 21 in. and (1) 30 in., by 21 in., by 74-5/8 in., high; five tier with bottom shelf up 14 in. clear above floor

Description - Unit shall be all standard construction with Super Adjustable Chrome plated wire shelves and tubular steel uprights with capped tops, adjustable feet, and 1 in. shelf height adjustment capability with Corner Release System. Each unit shall include four legs.

Item 15

DUNNAGE RACK

Quantity - 2

Make - Channel EXD2036 or equal by Kelmax or New Age

Size - 36 in. by 20 in. by 12 in. high

Description - Dunnage platforms shall be all standard construction with fully welded extruded Type 6063-T5 aluminum "E" channel top, gusseted channel legs, and each unit capable of supporting 3,000 pounds. Unit shall be provided with a lifetime guarantee against rust and corrosion.

Item 16

HAND SINK

Quantity - 3

Make - Advance 7-PS-70-CM or equal by Eagle or IMC Teddy

Description - Units shall be all standard stainless steel construction with mounting bracket. Mount on wall with rim at 36 in. above floor

Accessories - Provide with a splash mounted faucet set with wrist handles (Item 16A), 3 in. flat strainer type (non-basket, non-lever) open type waste, chrome plated tailpiece, "P" trap and clean-out cap.

Item 16A

FAUCETS

Quantity - 3

Make - T&S Brass B-0330-04 modified or Fisher 1953 modified or equal

Description - Units shall be all standard construction with mixing body, 8 in. center inlets, and wrist blade handles. Modified unit shall be provided with 119X gooseneck with B-0199-02-F10 aerator tip in lieu of the standard.

Item 17

TRASH BIN

Quantity - 4

No work in this Section. Item to be provided and installed by Owner.

Item 18

PREP TABLE WITH SINKS

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 8 ft., 0 in. by 30 in. by 36 in. high to work surface; two 18 in. by 20 in. by 10 in. deep integral sink basins

Construction - 14 gauge stainless steel top, splash and basins over angle frame, six legs with gussets and adjustable feet, flanged feet at the corners for securing to floor, two crossrails and partial undershelf, front and ends formed in turndown, rear splash, secured 3 in. off the face of wall.

Accessories - Drawer assembly, splash mounted faucet set and 2 in. lever waste outlet.

Item 19

WALL SHELF

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 96 in., by 10 in. mounted 1 in. off face of wall up 54 in. above finished floor

Construction - Wall shelf shall be fabricated of 16 gauge stainless steel with back and ends raised 1-1/2 in., front edges of ends angled back, all corners broken, and front turned down 1-1/2 in., and in 1/2 in. at 45°. Shelf corners shall be welded, ground and polished. Mount shelf 1 in. off face of wall with suitable fasteners on 14 gauge stainless steel flag brackets, 48 in. on center maximum. Flag brackets shall have a web angle of 30° measured from horizontal.

Item 20

VEGETABLE WASHER

Make - Firex Proc-X LWD-4 or equal by Powersoak or equal

Size - 59 in. by 27-1/2 in. by 35-1/2 in. high plus 3 in. high rear splash

Power - 17 amps - 480/60/3

Description - Vegetable washer shall be all standard stainless steel construction with 117 lbs. load per cycle, self-contained pumping system, automatic water filling, 75 gallon tank capacity, on/off switch, adjustable timer, overflow drain with removal stainless steel vessels, IPX5 wash down, mounted on stainless steel legs with adjustable feet, and provided with 3-year warranty on parts and labor.

Item 21

CAN OPENER

Make - Edlund S-11 or equal

Description - Opener shall be all standard construction with cast stainless steel body, base and blade. Install on table per plan.

Item 22

TRASH CONTAINER

Quantity - 4

No work in this Section. Item to be provided and installed by Owner.

Item 23

MOBILE STORAGE SHELVING

Quantity - 2

Make - MetroMax Q or equal by Eagle or Cambro

Size - 48 in. by 21 in. by 69 in., high on casters; four tier

Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5 in. diameter polyurethane tired swivel casters with donut bumpers.

Accessories - Provide with polymer posts in lieu of standard.

Item 24

DOUBLE CONVECTION OVEN

Quantity - 2

Make - Blodgett DFG-200-ES Double or equal by Montague or Vulcan

Size - 38-1/4 in. by 42-7/8 to include fan motor by 70-5/8 in. high

Power - (2) 8 amps - 1/3 HP - 120/60/1 - cords and plugs

Rating - 3/4 in. gas inlet at 100,000 BTU/Hour

Certification - Unit shall be Energy Star compliant

Description - Units shall be all standard construction with stainless steel front, sides and top, porcelain enameled steel interior with 29 in. by 28-1/4 in. by 20 in. high inside dimensions, 1 in. thick mineral fiber sheet insulation on top, back and sides, dual pane thermal glass windows in coupled doors, removable rack supports capable of holding eleven racks and five chrome plated steel wire racks, electronic ignition with fail-safe controls, solid state digital controls with separate temperature and time settings, timer with buzzer, cook and hold and fan pulse modes, manual gas service cut-off switch, removable dual tube burners, pressure regulators, two speed blowers with thermal overload protection and door interlock, and interior lighting with two 50 watt commercial bake oven lamps. Provide standard three year parts and labor warranty on the total oven and additional five year warranty on the door assembly exclusive of glass, parts only.

Accessories - Provide a stainless steel draft diverter and stainless steel finished back panel. Mount on heavy duty swivel casters. Manifold the two ovens for a single gas connection.

Item 25

RANGE WITH OVEN

Make - South Bend 4361D or equal by Montague or Vulcan

Size - 36-1/2 in. by 29-3/4 in. by 37 in. high to work surface

Rating - 3/4 in. rear gas inlet at 243,000 BTU/Hour

Description - Range to be standard commercial range with six individually controlled open cast iron grate top with six 33,000 BTU burners, battery spark piezo ignition, and controlled by three knobs. Oven base to have stainless exterior bottom, porcelain door lining, porcelain interior including oven bottom. Oven shall be provided with two rack guides and two removable chrome plated racks, thermostatic controls with 175 to 550 degree F. range, automatic oven safety pilot, exterior shall be stainless steel front, sides, back, and bottom.

Accessories - Provide a 24 in. high flue riser with high shelf with stainless steel front and ends. Mount on heavy duty swivel casters. Front manifold capped with a closure plate and provided with a rear gas connection. Provide assembly with a pressure regulator and a 48 in. long by 3/4 in. line size Dormont 1675 KIT2S plastic covered hose assembly with full port gas ball valve, two Supr-Swivels, brass disconnect, 90° street elbow and restraining cable. Mount the nipple on the rear of the range, and the hose assembly with disconnect device connected to the building supply line. Provide battery spark ignition.

Item 26

PRESSURELESS STEAMER

Quantity - 2

Make - Cleveland 24-CGA-10.2ES or equal by Groen or Market Forge

Size - 24" x 37" x 65-1/2" high overall on 6" high legs

Power - 150 watts each - 120/60/1 for fans and controls

Rating - 3/4" gas inlet at 100,000 BTU/hour

Description - Unit shall consist of a two five pan compartments mounted on a stainless steel cabinet base with 60 minute electro-mechanical timers with audible signal. Cooking compartments shall be covered corner stainless steel construction with insulation and equipped with a two piece door with floating inner piece and reversible gasket. Base cabinet to have stainless steel top, sides, and front and include a flue back. Unit must be Energy Star approved. Steam generator shall be AGA Approved, ASME Listed, 100,000 BTU/Hour capacity with electronic spark ignition, all required safety controls, automatic blowdown, automatic water fill, and a 15 psi safety release valve.

Accessories - Provide unit with automatic mineral purge cycle, six 12" x 20" x 2-1/2" deep perforated pans and four 12" x 20" x 2-1/2" deep solid pans.

Item 27

WATER FILTER ASSEMBLY

Quantity - 2

Make - 3M ScaleGard HT SF165 Modified, Everpure, OptiPure, or an approved equal

Description - Unit shall be all standard construction designed for wall mounting behind the steamer and consisting of a mounting bracket, quarter-turn cartridge release mechanism, manifold with integral pressure gauge, integral quarter turn shut-off valve, outlet check valve, filter cartridge with internal prefilter membrane and external scale feeder cartridge. Provide with HF95-CL chloramine reduction filter cartridge in lieu of standard HF65 cartridge.

Accessories - Provide four spare HF95-CL filter cartridges and four spare HF8-S cartridges.

Item 28

EXHAUST VENTILATOR

Make - Aquamatic AM-ND-2 or equal by Gaylord or Halton

Size - 9 ft., 0 in. by 60 in. by 24 in. high plus 4 in. high collars, plus 12 in. utility cabinet in right end; mounted up 6 ft., 8 in. above finished floor; flat bottom

Power - 0.3 KW - 120/60/1 to lights from item 32; installed by Electrical Contractor.

Exhaust - 2,070 CFM exhaust through a 14 in. diameter collar at -0.881 in. static pressure. Blower, control switches, and ductwork provided and installed by Ventilation Contractor.

Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edges with integral front baffle, double wall insulated fronts, and NSF Listed. Units shall have grease collection troughs, storage containers, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator, and seal to wall.

Accessories - Provide unit with three UL Listed recessed Allanson round LED light fixtures with LED lights, factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3 in. above finished ceiling to close to adjacent surfaces on three sides. Provide one filter removal tool and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 29

UTILITY DISTRIBUTION SYSTEM

Make - AquaMatic AM-UDI or equal by Caddy or Halton

Size - 17 ft., 6 in. by 12 in. by 6 ft., 8 in. high

Power - 50 amps circuit - 120/208/60/3

Rating - 2" gas manifold at 731 MBTU/Hour (1,450 MBTU/Hour capacity)

Description - Utility distribution system shall be all standard construction of 300 series stainless steel with primary service riser, secondary riser and a horizontal raceway with separate compartments for plumbing and electrical services. Plumbing compartment shall include a gas manifold with electric gas valve, service drops with shut-off valves, Dormont quick disconnect hoses and hot and flexible water connectors. Electrical compartment shall include bus bar with individually sized breakers along raceway. Primary riser shall include breaker panel with main shunt trip breaker, emergency kill switch with status lights, ventilator light and fans switches with covers, GFI convenience outlet, pre-plumbed 2 in. gas valve, and gas delay reset. Risers shall extend at ends with closure panels from top of riser to a point 3 in. above finished ceiling.

Accessories - Provide 36 in. long minimum Dormont swivel type quick disconnect gas hoses and restraining cables for Items 24 and 29; standard gas hoses for items 25 and 27. Provide matching horizontal stainless enclosures at bottom of ventilator, between risers. Provide stainless filler panel between UDS risers. Provide stainless steel wall flashing from top of coved base flooring material to underside of UDS.

Item 30

EXHAUST VENTILATOR

Make - Aquamatic AM-ND-2 or equal by Gaylord or Halton

Size - 7 ft., 6 in. by 60 in. by 24 in. high plus 4 in. high collars, mounted up 6 ft., 8 in. above finished floor; flat bottom

Power - 0.2 KW - 120/60/1 to lights from item 32; installed by Electrical Contractor.

Exhaust - 1,500 CFM exhaust through a 12 in. diameter collar at -0.711 in. static pressure. Blower, control switches, and ductwork provided and installed by Ventilation Contractor.

Description - Ventilator shall be of all standard construction, built of not less than 18 gauge 304 stainless steel throughout with welded joints and seams in accordance with NFPA-96, with reinforced front bottom edges with integral front baffle, double wall insulated fronts, and NSF Listed. Units shall have grease collection troughs, storage containers, and hanger brackets. Provide with 430 stainless steel Captrate Grease-Stop Solo Filter UL classified S-baffle extractors that shall remove at least 75% of grease particles five microns in size, and 90% of grease particles seven microns in size and larger, with a corresponding pressure drop not to exceed 1.0 inches of water gauge. Provide all materials necessary for the hanging of the ventilator, and seal to wall.

Accessories - Provide unit with two UL Listed recessed Allanson round LED light fixtures with LED lights, factory prewired and left ready for final connection by the Electrical Contractor. Provide closure trim per detail to a point 3 in. above finished ceiling to close to adjacent surfaces on three sides. Provide one filter removal tool and a full System Design Verification to be performed by a Factory Certified Technician once system start-up and inspections are completed.

Item 31

Spare number

Item 32

DCV CONTROL PANEL

Make - Aquamatic DCV or equal by Gaylord or Halton

Power - (2) 20 amps circuit - 120/60/1 to logic controller

Scope - Furnish and install complete exhaust control system for the exhaust canopy in accordance with the plans and Manufacturers shop drawings. The system shall include programmable logic controller (PLC), variable frequency drive (VFD), stainless steel control enclosure, exhaust duct temperature sensors, room temperature sensor, LCD screen interface with cable, all specified accessories, and those components required to provide complete and satisfactory systems in accordance with accepted HVAC practice. System shall control Items 28 and 30. Mount LCD screen control in UDS riser. Mount system processor in the cabinet mounted on the right end of exhaust ventilator Item 28.

Important: The installation work shall be performed by a fully qualified contractor employing a certified mechanic fully trained in the installation of the DCV hood system. Submittal shall list the installing company and the qualified system installer. Provide wiring diagrams and guidance to related trades to achieve correct operation of the system.

Accessories - Service Design Verification: Factory Services and on site coordination to be performed by the Manufacturers service technician (not a sales representative). On site supervision shall include two site visits: One visit to coordinate preparations for installation, and a second visit at startup and calibration. Provide BacNet monitoring system.

Item 33

DCV CONTROL INTERFACE

Specified as part of Item 32

Item 34
ROOM TEMPERATURE SENSOR
Specified as part of Item 32

Item 35
FIRE SUPPRESSION SYSTEM

Make - Ansul R-102 or equal by Kidde or Pyro-Chem

Design - Provide an automatic liquid fire suppressant system sized to meet all local codes, UL 300 and NFPA Codes. System shall provide surface protection for cooking equipment, hood and the exhaust duct work, if required. Tanks shall be mounted within the hood utility cabinet on the right end and piping shall run hidden wherever possible. All pipes and fittings used to convey the chemical shall be scale free steel, 40 weight. Exposed piping located within the ventilator shall be stainless steel or chrome and limited to vertical drops only. Horizontal piping shall be run over the ventilator's top. Nozzles shall be swivel type with metal caps. Detection shall be fusible links rated per codes, and system shall rely on no outside source of power. The system shall be provided with a control box with indicator to indicate system status. Control head shall also include integral micro switch offering "normally open" and "normally closed" terminals for use by the Electrical Contractor for the shut-down of equipment and the sounding of alarms, etc. Suppressant tanks shall be stainless steel. Provide a properly sized mechanically operated gas shut-off valve (up to 3 in. diameter) for mounting by the Plumber at a point in the gas supply that will shut off fuel to all gas fired equipment. Provide and install a remote pull station per codes, complete with cables, conduit and pulleys. Coordinate installation of remote pull station with General Contractor to provide a recessed junction box mounted for installing the pull box with cable conduit concealed within walls. Provide system with one class-K extinguisher.

Workmanship - Exposed stainless steel fittings and piping shall be assembled with special care to avoid marring or damaging the surfaces. Any pieces showing marks shall be removed and replaced with new materials. Chrome sleeves are not acceptable.

Test - Perform a puff test on the completed system and obtain the written approval of the local Fire Inspector.

Accessories - Provide metal caps on the nozzles.

Item 36
Spare number

Item 37

COOK'S TABLE WITH SINK AND PARTIAL OVERSHELF

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 8 ft., 6 in. by 30 in. by 36 in. high; overshelf 8 ft., 6 in. long with shelf at 54 in. above floor; 20 in. deep shelf; 18 in. by 20 in. by 10 in. deep integral sink basin

Construction - 14 gauge stainless steel top, splash, and sink basin over angle frame, all table ends formed in turndown, six legs with gussets, adjustable feet, flanged feet at the corners for securing to floor, two crossrails and partial undershelf. Overshelf shall be 16 gauge stainless steel, constructed similar to a wall shelf, channel reinforced, and welded to three extended rear table legs with support webs, and supported in integrally welded inverted gussets with sleeved joints for rigidity.

Accessories - Drawer assembly, deck mounted faucet set and a 2 in. lever waste outlet. Provide (4) enclosed outlet boxes for mounting of electric outlet in the setback position below the overshelf complete with GFI receptacle and stainless steel cover plate. Mount below the overshelf and pre-wire thru upright to junction box mounted below the table.

Item 38

MOBILE WORK TABLE

Quantity - 2

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 60 in. by 30 in. by 36 in. high

Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5 in. diameter swivel casters, two with brakes, and full undershelf.

Accessories - Drawer assembly.

Item 39

WORK TABLE

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 8 ft., 6 in. by 30 in. by 36 in. high

Construction - 14 gauge stainless steel top over angle frame, all table ends formed in turndown, six legs with gussets, adjustable feet, two crossrails and partial undershelf.

Accessories - Drawer assembly

Item 40

CEILING MOUNTED UTENSIL RACK

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 60 in. by 24 in. mounted up 6 ft., 6 in. and 7 ft., 6 in. above floor

Construction - Rack shall be fabricated of 1/4 in. by 2 in. stainless steel bar stock throughout, fully welded construction, consisting of a two bar upper rail with full radiused ends, a single lower rail, reinforcing straps, and suspended from the overhead structure on four hangers. Provide unit with forty Component Hardware J77-4401 stainless steel double pot hooks.

Item 41

PASS-THRU HEATED CABINET

Make - Victory HSA-1D-1-EW-PT-HD or equal by Continental or Utility

Power - 6.3 amps - 208/1 NEMA 6-20P

Description - Provide manufacturer's standard construction to include heavy gauge polished stainless steel cabinet front and doors with polyurethane foam insulation. Doors provided with cylinder locks and vertical handle. Door hinges to be self-closing with a hold open feature of 120° and automatic lights. Strip type safety shielded heating system located at the bottom of the cabinet interior controls by V-TEMP electronic control with a temperature range from 80°F to 180°F. Unit manufactured with an external mounted blower system with adjustable humidity control vent. Each cabinet to be provided with three heavy duty chrome plated adjustable shelves in 1 in. increments. Provide V-Temp controls with a two year parts and labor warranty. Control to be water resistant microprocessor monitor including on/off switch located on the control face, interior light switch, LED temperature indicator, audio/visual temperature alarm, and a door ajar alarm.

Accessories - Provide stainless steel case back and shroud.

Item 42

PASS-THRU REFRIGERATOR

Quantity - 2

Make - Victory RSA-2D-S1-EW-PT-HD or equal by Continental or Utility

Power - 11 amps - 120/1 - cord and plug

Description - Unit shall be all standard construction with stainless steel exterior front and doors and polyurethane foam insulation. Front shroud is removable for cleaning and service access. Door interior lined with stainless steel and door provided with cylinder lock and vertical handle. Door hinges to be self-closing and hold open feature at 120° with automatic LED lights. Concealed humidity control wires around the door jamb. Self-contained air cooled refrigeration system to be top mounted using R134a refrigerant. The hermetically sealed system is designed to operate at 38°F Dual Speed EC fan motor and plasticized fin coil and a non-electric condensate evaporator. Interior of cabinet to be provided with three heavy-duty, epoxy coated wire shelves adjustable in 1 in. increments. Unit provided with Secure-Temp technology and V-temp electronic control system.

Item 43

PASS-THRU HEATED CABINET

Make - Victory HSA-2D-1-EW-PT-HD or equal by Continental or Utility

Power - 13 amps - 208/1 NEMA 6-20P

Description - Provide manufacturer's standard construction to include heavy gauge polished stainless steel cabinet front and doors with polyurethane foam insulation. Doors provided with cylinder locks and vertical handle. Door hinges to be self-closing with a hold open feature of 120° and automatic lights. Strip type safety shielded heating system located at the bottom of the cabinet interior controls by V-TEMP electronic control with a temperature range from 80°F to 180°F. Unit manufactured with an external mounted blower system with adjustable humidity control vent. Each cabinet to be provided with three heavy duty chrome plated adjustable shelves in 1 in. increments. Provide V-Temp controls with a two year parts and labor warranty. Control to be water resistant microprocessor monitor including on/off switch located on the control face, interior light switch, LED temperature indicator, audio/visual temperature alarm, and a door ajar alarm.

Accessories - Provide stainless steel case back and shroud, and mount unit on 6" high casters.

Item 44

MOBILE WORK TABLE

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 72 in. by 30 in. by 36 in. high

Construction - 14 gauge stainless steel top over angle frame with edges formed in turndown and mounted on four legs with gussets, 5 in. diameter swivel casters, two with brakes, and full undershelf.

Accessories - Drawer assembly.

Item 45

REFRIGERATED SELF SERVICE CASE

Quantity - 2

Make - Structural Concepts CO33RM-UC or equal by Federal or RPI

Size - 36-1/4 in. by 32-3/8 in. by 33-3/4 in

Power - 10.74 amps - 120/60/1 - NEMA L5-15P cord and plug

Description - Unit shall be all standard construction per the manufacturer's details. The refrigerated self-service merchandiser shall have a single-tier refrigerated section for holding chilled merchandiser at 40° F, bottom mounted refrigerated system with ventilated front toe-kick for air circulation, top mounted LED lights, removable deck pans and leveling casters. Comes standard with a one year parts and labor, plus five year compressor warranty.

Accessories - Provide six feet long power cord set, laminated colors as selected by the architect, stainless steel interior, two units with end shelves on both ends and removable night covers.

Item 46

SERVING COUNTER

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 21 ft., 1 in. by 34 in. high

Power - (2) 20 amps circuit - 120/60/1 to each of two apron mounted GFI outlets

(2) 20 amps circuit - 120/60/1 to each of two body mounted GFI outlets

Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate with Quartz edges for a total thickness of 2 in. Mount on angle frame, and provide opening for the drop-in heated surface assembly with thermal protection at all edges per detail. Provide counter opening to accept refrigerated display case to be installed from rear. Mitre stone at front end of counter as shown on plan

Counter tops: Superior Marble and Granite LLC (Middleton, Ma)

Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on twelve 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist. Provide counter filler on server side of counter, continuous at rear or operator side.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45°. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with panels prepared to accept a tile finish by the General Contractor.

Panels shall be secured to counter legs and crossrails with welded stainless steel clips and stainless steel wood screws. Do NOT secure THROUGH the legs or crossrails. Provide a continuous 14 gauge support-protector strip at the lower edge of all finish panels, extending 1/16" past front face.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with a 68 in. long Versa-Gard VG2 convertible breath guard mounted over the heated surface, with brushed stainless steel finish. Mount to counter top from below using concealed mount flanges.

Item 47

HEATED BLACK GLASS SHELF

Quantity - 2

Make - Hatco - GRSB-60-F or equal

Size - 60 in. by 15-1/2 in. plus perimeter flange

Power - 7.9 amps - 900 watts - 120/60/1 - cord and plug

Description - Hardcoat aluminum top plate clad with blanket foil element, thermostatic controls with 80 degree to 200 degreeF. range, bottom insulation and flanged edge for drop-in installation, and mounted controls.

Accessories - Provide with flush mount control box with lighted power switch for mounting in counter apron.

Item 48

HEAT LAMP

Quantity - 2

Make - Hatco GRN-54 or equal by Eagle or Nemco

Power - 5 amps - 208/60/1

Description - Provide manufacturer's standard.

Accessories - Provide remote infinite control with toggle switch for mounting in the counter by the fabricator. Provide shroud for mounting within sneeze guard assembly to match sneeze guard post finish.

Item 49

SERVING COUNTER

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 11 ft., 6 in. by 34 in. high

Power - (2) 20 amps circuit - 120/60/1 to each of two apron mounted GFI outlets
(2) 20 amps circuit - 120/60/1 to each of two body mounted GFI outlets

Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate with Quartz edges for a total thickness of 2 in. Mount on angle frame, and provide openings for the drop-in heated surface assembly with thermal protection at all edges per detail. Provide counter opening to accept refrigerated display case. Mitre stone at front edge of counter as shown on plan.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma)

Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Mount on eight 2 in. square 16 gauge stainless steel tubular legs with Component Hardware A15-0851 adjustable feet. Reinforce between all front and end legs with 2 in. square stainless steel tubing welded in place 6-1/4 in. clear above floor. Provide similar reinforcement between rear legs where an undershelf does not exist.

Undershelves shall be fabricated of 16 gauge stainless steel with reinforcing and sound deadening as specified for open base table undershelves. Front face shall be turned down 1-1/2 in. and in 1/2 in. at 45°. Rear and ends shall be turned up 1-1/2 in. and corners welded. Weld to legs at a point 10 in. above floor. Shelf shall be mounted on the inside face of legs, not cut-out at each leg. Leave 2 in. clearance between the shelf edge and the counter front and end panels for passing of services by Related Trades.

Front and ends of counter shall be provided with panels prepared to accept a tile finish by the General Contractor.

Apron shall be provided per elevations, fabricated of 18 gauge stainless steel, and shall be used for the mounting of switches, outlets, and controls. Apron shall include a formed reinforced bottom edge and shall be set in 1 in. from leg face.

Accessories - Provide with a 68 in. long Versa-Gard VG2 convertible breath guard mounted over the heated surface, with brushed stainless steel finish. Mount to counter top from below using concealed mount flanges.

Item 50
Spare number

Item 51
MOBILE CASHIER STAND

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 30 in. by 30 in. by 36 in. high main section with 42 in. by 12 in. trayslides set at 33 in. above floor; mitered trayslide corner per plan

Construction - Top shall be 1-1/4 in. Quartz over a 3/4 in. marine grade plywood substrate with Quartz edges for a total thickness of 2 in. and mounted on angle frame. Quartz color shall be as selected by Architect from full range of premium options. Mount on four 2 in. square legs with crossrails on three sides, footrest set in 8 in., undershelf and plastic laminate clad panels on three sides and two solid mounted 14 gauge stainless steel trayslides all of similar construction to the serving counter. Provide 5 in. diameter swivel casters; two with brakes. Mount trayslides on fold-down brackets.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma)

Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Accessories - Provide unit with a Component Hardware S95-1000 locking cashier drawer.

Item 52
POS TERMINALS

No work in this Section. Item to be provided and installed by Owner.

Item 53
TENZA BARRIER BOLLARD

Quantity - 4

Make - Lawrence TensabARRIER 889 Advance/Universal Base or equal

Size - 38-1/4 in. high post; 13-1/2 in. diameter base; 7 ft., 6 in. maximum belt length

Description - Units shall be all standard construction with satin stainless steel finish, and retractable belts. Belt color shall be as selected by Architect from standard options.

Item 54

MOBILE CONDIMENT COUNTER

Quantity - 2

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 48 in. by 30 in. by 34 in. high

Construction - Top shall be 1-1/4 in. quartz over 3/4 in. plywood substrate with quartz edges for a total thickness of 2 in., and mounted on angle frame. Quartz color shall be as selected by Architect from full range of premium options. Mount on four 2 in. square legs with casters; two locking, undershelf and plastic laminate clad panels at front, all of similar construction to the serving counters. Front face shall be provided with two pairs of hinged doors.

Counter tops: Superior Marble and Granite LLC (Middleton, Ma)

Description - Stone counter top to be provided per details with color selected by the Architect. The edge details/treatments shall be supplied in accordance with the counter details. Supply tops with Superior Marble and Granite model number SMGW2 (two-year warranty on all seams). Supply with model SMGEZCUT where all cut outs to be insulated and prepared to receive equipment drop-ins. Cut out where appropriate shall receive model (ProtectX232) flanges.

Item 55

TROUGH COLLECTOR

Make - Salvajor S419 or equal by Insinkerator or Red Goat

Power - 5.5 amps - 208/60/1

Description - Scraper shall be all standard construction with stainless steel tank, salvage trap, and molded plastic strainer basket. Water shall be recirculated by means of a 35 gallon per minute centrifugal pump with corrosion resistant impeller and housing. Unit shall be complete with an air gap water inlet, two solenoid valves, blending valve, flanged trough inlet, and an SS-33 motor controller in a NEMA 4X watertight corrosion resistant enclosure with magnetic contactor, 24 volt control circuit transformer, line disconnect, run light and start stop buttons mounted in the cover.

Accessories - Provide unit with end-of-trough and two mid trough gusher water diffusers, pre-plumbed by the Fabricator in accordance with Detail 9, Drawing K-4, with individual quarter-turn ball type throttling valves, union joints, cleanout at the diffuser end, and connected to the pump. Mount the controller to the underside of table as shown on plans.

Item 56

SOILED DISHTABLE

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 7 ft., 4 in. by 30 in. plus 6 ft. 10 in. by 30 in. return to dishwasher;
3 in. high raised open roll on working face; 48 in. by 24 in. pass thru with 35 in. sill height; opening for trough collector and a 6" trough.

Construction - 14 gauge stainless steel top, trough and splash, channel frame, eight legs with gussets, flanged feet, six cross rails. Secure 3 in. off face of wall with brackets. Turn end down into dishwasher and secure with stainless steel machine screws. Trough shall be coved and integral to the top and provided with a fabricator piped water inlet at the end with deflector and three gusher heads for connecting to the trough collector. Top of splash at water valve shall be fitted with integral flat spot for mounting of the hose reel fixture. Top shall pass through the wall and be an integral part of the pass window. Pass-thru ledge shall extend through the wall and be secured to the frame. Provide a 16 gauge stainless steel telescoping window frame at the opening with front edges turned out 2 in. and returned 1/2 in. Rear edges to be turned out 2-1/2 in. flat to wall.

Accessories - Provide three trough water flush nozzles per plan.

Item 57

ROLL-DOWN SHUTTER

Make - Raynor DuraShutter Select/surface mount or equal

Size - Opening approximately 52 in. wide by 48 in. high; verify

Description - Assembly shall be all standard construction and shall consist of a self-coiling roll-up door, all stainless steel construction with 22 gauge Type 304 slats, #4 finish where exposed, stainless steel endlocks riveted to each end of alternating slats, 13 gauge stainless steel guides, stainless steel angle bottom bar with thumb-turn locks, designed for surface mounting with stainless steel guides, and complete with inside lifting handle, slide bolt, and complete covers. Secure to wall. Provide bottom with foam rubber astragal.

Installation - Install with tracks located 1 in. clear above table surface to permit proper cleaning.

Item 58

HOSE REEL ASSEMBLY

Make - T&S Brass B-1457 (modified) or equal by Fisher or Reel Craft

Size - 12 foot hose, 3/8 in. ID

Description - Unit shall be all standard construction with stainless steel open type reel, adjustable bumper, blue hose, heat resistant spray valve handle, chrome risers, two wall brackets, continuous pressure vacuum breaker, 36 in. flexible water hose, control valve, and base faucet, designed for wall mounting per plan up 7 ft., 6 in. measured at the inlet.

Accessories - Provide unit with a B-7102 hose reel, a 002824-40 deck type base faucet, and a B-0107-C low flow (0.65 GPM) spray valve in lieu of standard.

Installation - The hose reel bracket for wall mounted units shall be rotated 90 degrees downward and installed such that it allows the hose to hang straight down and parallel to the wall. Refer to T&S Brass instructions manual page four figure one for further details.

Item 59

RACK CONVEYOR WAREWASHER

Make - Hobart CL44eR Advansys R-L or equal by Champion or Meiko

Size - 43-1/2" x 31-1/4" x 65-1/2" high

Power - 28.3 amps - 480/60/3 (includes motors, controls and tank heat)
40.1 amps 480/60/3 (internal booster heater)

Description - Unit shall be standard construction, double tank, fully automatic, rack conveyor type with 16 gauge stainless steel wash and rinse chambers, welded stainless steel frame and motor supports, stainless steel chambers, housing, insulated inspection doors and legs with adjustable feet. Conveyor structure, tracks, and drive unit to be all stainless steel with a conveyor speed of 5.6 feet per minute. Warewasher to be complete with top mounted stainless steel control module with "start/stop" button and digital display. Unit shall have an energy recovery system with heat exchanger for pre-heating supply water for the booster heater.

Accessories - Provide machine with built-in pressureless stainless 15 KW booster heater, single point connection for motors and tank heat, two vent hoods with 4 in. by 16 in. stainless steel stacks all welded water tight complete with locking dampers. Provide machine with higher than standard chamber to permit passage of racked 18 in. by 26 in. pans and trays, four plastic peg racks and two plastic flat racks. Provide single point electrical connection and water tempering kit and ten plastic racks.

Item 60

STAINLESS STEEL EXHAUST DUCTS

Quantity - 2

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 4 in. by 16 in. with length as necessary to reach 3 in. above finished ceiling

Construction - 18 gauge stainless steel welded exhaust ducts, sized to suit the vent stacks. Ducts shall be provided with a one-piece perimeter angle collar at the ceiling, installed "leg up".

Item 61

CLEAN DISHTABLE

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 6 ft. 11 in. by 30 in. by 34 in. high plus 10 in. splash at rear; 3 in. high raised roll at front and right end.

Construction - 14 gauge stainless steel top and splash over channel frame with raised roll front and right end, tall splash at rear, turned down into dishwasher and secured with stainless steel machine screws, and mounted on four legs with gussets, adjustable feet and undershelf. Secure table 3 in. off face of wall.

Item 61a

WALL SHELF

Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)

Size - 48 in. by 10 in. mounted 1 in. off face of wall up 54 in. above finished floor

Construction - See item 19

Item 62
TRAY DOLLY
Quantity - 2
Make - Metro SSD16 or equal by Cambro or Lakeside
Description - Provide manufacturer's standard.

Item 63
CLEAN DISH STORAGE
Quantity - 2
Make - MetroMax Q or equal by Eagle or Cambro
Size - 48 in. by 21 in. by 69 in., high on casters; four tier
Description - Shelving unit shall be all standard construction and shall consist of four shelves with removable injection molded polypropylene mats with antimicrobial product protection, supported on epoxy coated steel shelf frames and similar uprights with capped tops, and mounted on 5 in. diameter polyurethane tired swivel casters with donut bumpers.
Accessories - Provide with polymer posts in lieu of standard.

Item 64
THREE COMPARTMENT SINK
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)
Size - 10 ft., 0 in. by 30 in. by 34 in. high plus 10 in. high splash at wall; 3 in. high raised open roll on three sides; three 21 in. by 27 in. by 12 in. deep integral sink basins
Construction - 14 gauge stainless steel drainboards, basins and splash, stainless steel channel reinforced, mounted on eight legs with gussets, adjustable feet, seven lengths of crossrail, and secured 3" off face of wall. Accessories - Two splash mounted faucet sets, three 2" lever waste outlets.

Item 65
WALL SHELF
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)
Size - 60 in. by 10 in. mounted 1 in. off face of wall up 54 in. above finished floor
Construction - See item 19

Item 66
STAINLESS STEEL CORNER GUARD
Make - Fabricate per General Construction this Section by Custom Metals of Massachusetts, Carbone Metal Fabricators, or LTI (Low Temp Industries)
Quantity - 6
Size - 3 in. by 3 in. by 48 in. high
Description - Fabricate from 14 gauge 304 stainless steel, break long edges so that guards "hug" the wall when installed. KEC to field verify angle prior to fabrication. Secure with suitable adhesive and six maximum stainless steel fasteners per unit.

PART 3 - EXECUTION

3.01 SANITATION REQUIREMENTS

- A. Equipment specified herein shall be fabricated to conform to the "Food Service Equipment Standards" of the National Sanitation Foundation prepared by the Committee on Food Service Standards, and published by the National Sanitation Foundation, Ann Arbor, Michigan. Any differences of opinion on sanitation shall be referred to the State Department of Health for a ruling.
- B. Equipment shall be installed in accordance with the manufacturer's instructions and the best practices of the food service industry, with careful attention to eliminating all cracks, crevices and concealed spaces in wet areas that would be difficult to clean or keep free of vermin and soil.

3.02 EXAMINATION AND ACCEPTANCE

- A. Determine whether the General Contractor will furnish and provide temporary power and light, openings and storage space to permit scheduled delivery of equipment. Verify water pressure and provide necessary reducing valves.
- B. Examine space in which specified work is to be installed to assure that conditions are satisfactory for the installation of specified work. Report in writing to the Architect, any deficiency in the work of other contractors affecting specified work. Commencement of specified work shall be construed as acceptance of space conditions.
- C. Obtain and verify all measurements and conditions on the job, and assume responsibility in respect to same.
- D. Inspect flooring and raised concrete bases, wall finishes, painting, ceiling installation and all related work for readiness to commence installation of foodservice equipment. Verify the existence of required mechanical and electrical rough-ins.

3.03 CLEANING UP

- A. Debris and surplus materials resulting from installation work shall be removed promptly as work progresses, to a location indicated by the General Contractor.
- B. Following completion, and before final acceptance by the Owner, clean finished surfaces in accordance with the manufacturer's instructions, and leave specified work free of imperfections.

3.04 DEMONSTRATION AND OPERATING INSTRUCTIONS

- A. Before final acceptance, and by appointment with the Owner and his representatives, completely demonstrate with power, the correct operation of each new item of operating equipment.
- B. Prior to the demonstration, turn on all mechanical and electrical foodservice equipment. Test for leaks, poor connections, and inadequate or faulty performance and correct if necessary. Adjust for proper operation. Thermostatically controlled equipment and

equipment with automatic features shall be operated for a sufficient length of time with proper testing equipment to prove controls are functioning as intended. Recalibrate thermostats if necessary.

- C. Provide Architect or Consultant with a loose leaf bound manual of operating data and maintenance instructions containing complete description, wiring diagrams, operating data, maintenance requirements and other information pertaining to the proper operation and upkeep of the various items of electrical or mechanical equipment. Include names, addresses and telephone numbers of authorized service agencies for all items. Arrange all material in alphabetical order by Manufacturer. Book shall be turned over to Owner after review and approval.
- D. Submit guarantees and warranties to the Architect in the above specified manual with all warranty cards completed and becoming effective at the time the equipment was satisfactorily demonstrated.

3.05 PROTECTION OF WORK

- A. Protect specified work from damage during transportation to the project site, storage at the site, during installation, and after completion until acceptance by the Owner.
- B. Protect adjacent work under other contracts during installation until completion of specified work. After completion, the contractor for other work shall be responsible for the protection of his work until acceptance by the Owner.
- C. Damaged work as determined by the Architect, shall be repaired or replaced as determined by and to the satisfaction of the Architect.

End of Section

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Section 11 52 13
PROJECTION SCREENS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Electrically operated, ceiling mounted projection screens.
 - 1. Type 1 Screens – Auditorium and Gymnasium.
 - 2. Type 2 Screens – Learning Commons.

1.3 RELATED SECTIONS

- A. Section 05 50 00 – METAL FABRICATIONS: Overhead supports for suspended (ceiling-mounted) projection screens.
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- C. Section 09 22 16 - METAL SUPPORT ASSEMBLIES: Metal framing and ceiling suspension system for gypsum board surfaces.
- D. Section 09 29 00 - GYPSUM BOARD: Gypsum board ceilings.
- E. Section 09 51 00 – ACOUSTICAL CEILINGS: Acoustical tile ceilings.
- F. Division 26 - ELECTRICAL: Electrical connections to projection screens, empty conduit from motor to control.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets for projection screens, including electrical characteristics.
 - 2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
 - 3. Manufacturer's sample warranties.
 - 4. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
 - 1. Manufacturer's warranty.

2. Maintenance information on regular cleaning, stain removal for screen surfaces.

1.5 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Provide manufacturer's standard warranty which shall include coverage of screen surfaces from discoloration. Warranty is in addition to and not in lieu of, other liabilities which the Construction Manager may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Draper, Inc. Spiceland, IN.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Draper, Inc. Spiceland, IN.
 2. Da-Lite Screen Company, Inc., Warsaw, IN.
 3. Stewart Filmscreen Corporation, Torrance, CA.

2.2 DESCRIPTION

- A. General Requirements: Manufacturer's standard UL-listed and marked automatic electric projection screen: units consisting of case, screen, motor, controls, mounting accessories and other components and complying with the following requirements
 1. Motor: Instant reversing motor in size and capacity recommended by screen manufacturer, with permanently lubricated bearings, automatic thermal overload protection, preset limit switches to automatically stop screen in "up" and "down" position, and positive stop action to prevent coasting; and as follows:
 - a. For end-mounted-motors mount motors on end indicated.
 - b. For motor-in-roller-units mount motors with vibration insulators to reduce noise transmission.
 2. Screen Control: Single station control with low voltage control system consisting of a single control unit, directionally lighted, single button control stations of number and at locations indicated, with metal device boxes and flush cover plates.
 3. Case and brackets: Furnish and install ceiling mounted projection screen cases fabricated from 3/4 inch thick, warp-resistant composite wood panels with hinged panel for metal lined motor compartment. Case bottom shall fully enclose case assembly with an integral slot to allow for passage of the screen fabric. Finish case assembly with manufacturer's standard prime coat.

- a. Provide 1/4 inch thick case mounting brackets configured to wrap under the bottom edge of the case assembly.

2.3 ELECTRICALLY OPERATED SCREEN UNITS

A. Type 1 Screen.

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Draper, Inc., Product: "Paragon V" ceiling mounted motorized tab-tensioned projection screen, refer to Drawing AV301.
2. Case: Fully enclosed extruded aluminum case with slot for viewing surface passage, provided with mounting brackets for above ceiling mounting.
3. Screen Characteristics: Provide mildew-resistant and flame-resistant glass fiber fabric mounted on rigid roller, with vinyl-coated viewing surfaces complying with the following requirements:
 - a. Viewing Area: (height by width) 146 inches by 260 inches.
 - b. Viewing surface: Draper "TecVision, type XH900X ALR screen material.
 - c. Recommended viewing cone: 130 degrees.
 - d. Edge treatment: Black masking borders.
 - e. Provide extra drop length: refer to Drawing AV301.
 - f. Direction of roll: Reverse roll.
 - g. Low voltage control system.
4. Tab-Tensioning System: Viewing surface with integrated tabs and cable on each side of fabric to provide tension and ensure flat viewing surface. Viewing surface and tabs CNC cut as a single piece. Tabs RF welded to the back of viewing surface to prevent tab separation. Tab adhesives are not acceptable. Warranted for 5 years against tab separation. Viewing surface inserted into aluminum bottom dowel.

B. Type 2 Screen.

1. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on Draper, Inc., Product: "Access Fit V" ceiling mounted motorized tab-tensioned projection screen, refer to Drawing AV302.
2. Case: Steel case recessed into ceiling, fabricated from 18 gauge steel, with factory applied white painted finish, and stamped 13-gauge steel end caps. Bottom closure panel forms slot for passage of viewing surface and can be released to hang down or be removed for access to operating mechanism and viewing surface. Bottom perimeter flange provides support and trim for acoustical ceiling panels and trim for gypsum board ceiling.
3. Screen Characteristics: Provide screen for moderate-ambient light conditions, mildew-resistant and flame-resistant glass fiber fabric mounted on rigid roller, with vinyl-coated viewing surfaces complying with the following requirements:
 - a. Viewing Area: (height by width) 6'-0" by 9'-7.2".
 - b. Viewing surface: Draper "TecVision, type XH900X ALR screen material.
 - c. Recommended viewing cone: 130 degrees.
 - d. Edge treatment: Black masking borders.

- e. Provide extra drop length: refer to Drawing AV302.
- f. Direction of roll: Reverse roll.
- g. Low voltage control system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and concealed blocking are ready to receive work of this Section.
- B. Beginning of installation means acceptance of existing substrate.

3.2 INSTALLATION

- A. Verify that electric power is available and of the correct characteristics.
- B. Install projection screen units in accordance with manufacturer's instructions. Install projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.
 - 1. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

3.3 CLEANING

- A. Clean projection screen surfaces in accordance with manufacturer's instructions.
- B. Cover units with protective cover taped to frame. Remove cover at Date of Substantial Completion.
- C. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

Section 11 53 00
LABORATORY EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Chemical storage cabinets.
 - 2. Flammable material storage cabinets.
 - 3. Safety glass goggle cabinets.

1.3 RELATED REQUIREMENTS

- A. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.
- B. Section 11 31 00 – RESIDENTIAL APPLIANCES: Dishwasher.
- C. Section 11 53 13 - LABORATORY FUME HOODS: Laboratory fume hoods, related component fittings, fixtures, and accessories.
- D. Section 12 35 53 - LABORATORY CASEWORK: Manufactured laboratory casework.
- E. Division 22 - PLUMBING: Connections to all plumbing work furnished under this Section.
- F. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Fume hood vent connections and ductwork (from hood duct collar to hood exhaust system). Venting at storage cabinets.
- G. Division 26 - ELECTRICAL: Electrical work related to items in this Section

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
 - 3. Selection samples: Sample card indicating Manufacturer's full range of colors available for selection by Architect.

4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver equipment to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
- C. Deliver and store equipment in original, sealed packaging showing manufacturer's identification and model number.
- D. Protect equipment from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Justrite Manufacturing Company, Inc., Des Plaines, IL.
 2. Eagle Manufacturing Company, Wellsburg, WV.
 3. Scientific Materials Company, Inc., Batavia, IL.
 4. Securall/A & A Sheet Metal Products, LaPorte, IN.

2.2 SCIENCE CLASSROOM EQUIPMENT

- A. Flammable/Corrosive Storage Cabinets:
 1. Acid storage cabinets:
 - a. Cabinets: 4 gallon bench top cabinet fabricated from polypropylene with adjustable shelves, 2 inch vents with caps, door storage for smaller containers and lockable.
 - 1) Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Eagle Manufacturing Company, Wellsburg, WV, Product, EAGLE Poly Acid/Corrosive Safety Cabinet Model CRA-P04.
 2. Flammable storage cabinets:
 - a. Cabinets: NFPA and OSHA compliant 4 gallon bench top cabinet fabricated from 18 gauge steel with double wall construction incorporating a 1-1/2 inch air space, two vents with 2 inch threaded fittings, fire baffle and caps and double doors with 3 point locks, 2 inch raised leak proof sill. Shelves shall be capable of supporting up to 350 pounds each.
 - 1) Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on

Eagle Manufacturing Company, Wellsburg, WV, Product, EAGLE
Safety Cabinet Model 1904. 3.

- B. Safety Glass Goggle Cabinet:
1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermo Fisher Hamilton Model No. 58L02110.
 2. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Thermo Fisher Scientific, Two Rivers, WI.
 - b. Sellstrom Manufacturing Company, Palatine, IL.
 - c. Institutional Casework, Inc., Campbell Rhea, Paris, TN.
 - d. Kewaunee Scientific Corporation, Statesville, NC.
 3. Features: 24 gauge steel fabricated case with white enamel finish, automatically timed germicidal lamp with plug cord for 115 v single phase outlet, key locked with vault rods. Safety interlock switch turns off UV light when doors are opened.
 4. Size: 9-1/2 inches deep by 24-1/2 inches wide by 32 inches high with a capacity of holding 30 pairs of chemical splash goggles.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Construction Manager, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.
- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

- A. Install each product in accordance with manufacturers' instructions.
 1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.
- B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- C. Anchor equipment using devices appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

- A. Adjust equipment to ensure proper working order and conditions.
- B. Remove and replace equipment creating excessive noise, or vibration.
- C. After installation is completed, insure that operating parts work freely and fit neatly. Adjust hardware and catches. Repair or replace damaged parts dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.4 CLEANING

- A. Clean Work under provisions of Section 01 73 00 - EXECUTION:
 - 1. Wash and clean equipment.
 - 2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.
- B. Remove protective coverings from prefinished work just prior to Owner's acceptance of facility.

End of Section

Section 11 53 13
LABORATORY FUME HOODS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This Section includes laboratory fume hoods, related component fittings, fixtures, and accessories required for a fully piped and wired unit ready for attachment to building mechanical, plumbing and electrical systems.
 - 1. ADA compliant demonstration type fume hoods.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction recycling.
- B. Section 11 53 00 - LABORATORY EQUIPMENT.
- C. Section 12 35 53 – LABORATORY CASEWORK: Laboratory casework, epoxy resin tops.
- D. Division 22 - PLUMBING: Connections to all plumbing work furnished under this Section.
- E. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Fume hood vent connections and ductwork (from hood duct collar to hood exhaust system).
- F. Division 26 - ELECTRICAL: All electrical work related to items in this Section

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ADAAG - Accessibility Guidelines for Buildings and Facilities
 - 2. ANSI/ASHRAE Standard 110.1995 - Method of Testing Performance of Laboratory Fume Hoods
 - 3. ASTM D 552 – Bending Test

4. ASTM D 2197 - Standard Method of Test for Adhesion of Organic Coatings.
5. ICC/ANSI A117.1 - Providing Accessibility and Usability for Physically Handicapped People.
6. NSF/ANSI Standard 49 – Photometric Method of Testing.
7. NIH03-112C - National Institute of Health Specification
8. UL 1805 – Underwriters Laboratories Fume Hood Classification
9. NFPA 45 – Standard on Fire Protection for Laboratories Using Chemicals

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
2. Coordinate installation of fume hoods with laboratory casework, fume hood exhaust ducts, and plumbing and electrical work.

B. Pre-Installation Meetings: At least two weeks prior to commencing the work of this Section, conduct a pre-installation conference at the Project site. Comply with requirements of Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Coordinate time of meeting to occur prior to installation of work under the related sections named below.

1. Required attendees: Owner or designated representative, Architect, Construction Manager, Installer's Project Superintendent, manufacturer's technical representative and representatives of other related trades as directed by the Architect or Construction Manager, and representatives for installers of related work specified under the following Sections:
 - a. Division 22 - PLUMBING.
 - b. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING.
 - c. Division 26 – ELECTRICAL.
2. Agenda:
 - a. Scheduling of operations.
 - b. Review of staging and material storage locations.
 - c. Coordination of work by other trades.
 - d. Installation procedures for ancillary equipment.
 - e. Protection of completed Work.
 - f. Discuss process for manufacturer's inspection and acceptance of completed Work of this Section.

C. Sequencing:

1. Field Measurements:
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Scheduling:

1. Coordinate schedule of construction, size of access and route to place of installation to prevent delay of installation due to physical impediments. Any work involving the demolition and reconstruction of partitions, walls, floors, roofing, windows, or doors to place and install the work of this Section shall be performed at no additional cost to the Owner.

1.6 SUBMITTALS

A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Manufacturer's data for each type of fume hood including service fittings.
2. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
3. Certificates: Provide manufacturer's certification and test data indicating compliance with ASRAE Standard 110-1995 with a performance rating of 4.0 (tracer gas release in liters/minute), AM (as manufactured), 0.01 (level of control of tracer gas in parts per million (ppm)).
4. Shop drawings for fume hoods, showing plan layout, elevations, ends, cross-sections, service run-spaces, location and type of fixtures and service fittings, together with indication of associated service supply connections required.
 - a. Include details and location of anchorages and fitting to floors, walls, and base.
 - b. Include layout of units with relation to surrounding walls, doors, windows, lighting and air-conditioning fixtures, connections of hood-to-hood exhaust system, location of access doors, cut-off valves, junction boxes.
 - c. Coordinate shop drawings with other trades whose work affects installation or performance of fume hood.
 - d. Provide roughing-in drawings for mechanical and electrical services.

1.7 QUALITY ASSURANCE

- A. Catalog Standards: Manufacturer's catalog numbers may be indicated on drawings for convenience in identifying certain fume hoods. Unless modified by notation on drawings or otherwise specified, manufacturer's current catalog description for indicated number, together with indicated or specified options or accessories, constitutes requirements for each such unit.
1. Use of catalog numbers and specific requirements indicated on drawings and in specification are not intended to preclude use of equivalent products by other listed acceptable manufacturers, but are given for purpose of establishing a minimum standard of design and quality for materials, construction, workmanship, capacity, and performance of each fume hood.
- B. General Performance: Design fume hoods so that, when connected to exhaust system that provides proper exhaust volume under normal laboratory conditions, fume hoods will operate in a safe, efficient manner, within acceptable tolerances for face velocities specified. Dead-air pockets and reverse-air currents will not be permitted along surface of hood interiors.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Coordinate delivery of fume hoods with delivery of other laboratory casework components.
- B. Delivery and Storage: Deliver materials under protective cover and store within dry enclosed space. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no change in Contract Sum.

1.9 WARRANTY

- A. Provide manufacturer's one-year warranty against all defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Kewaunee Scientific Corporation, product: "Supreme Air TruView Teaching Hood" ADA Configuration, Model T90M6048-SA, (double sided)", and Model T90M3048-SA (Single Sided)
 - 1. Double hood superstructure with base cabinets.
 - 2. Static Pressure:
 - a. 80 FPM: Static Pressure 0.15.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Kewaunee Scientific Corporation, Statesville, TN.
 - a. Product: "Supreme Air TruView Teaching Hood".
 - 2. Fisher Hamilton Scientific, Two Rivers, WI.
 - a. Product: "Safeaire Pass-Through Demonstration Assembly".
 - 3. Labconco Corporation, Kansas City, MO.
 - a. Product: "Protector ClassMate Laboratory Hood".
 - 4. Mott Manufacturing, Ltd., Brantford, Ontario, CN.
 - a. Product: "Observation Fume Hood".
 - 5. Bedcolab, Ltd., Laval, Quebec, CN.
 - a. Product: "Vision Student Laboratory Fume Hood".

2.2 DESCRIPTION

- A. The hoods shall be of the bypass type. The fume hood design shall allow for automatic air bypass above the sash opening. The bypass shall limit the maximum air velocity through the face of the hood and provide for a constant volume of air through the hood regardless of sash position. The bypass shall control the increase

in face velocity as the sash is lowered to limit the maximum velocity to not more than three and one-half, times the velocity with the sash full open.

1. Fume hoods shall be delivered fully assembled including pre-wired and pre-plumbed ready for connection to building mechanical electrical and plumbing systems.

B. Regulatory Requirements:

1. All designs, clearances, construction, workmanship, and material, unless specifically excepted, shall be in accordance with the requirements of:
 - a. Commonwealth of Massachusetts Regulation 521 CMR: Architectural Access Board, as amended.
 - b. NFPA 70 National Electrical Code.
 - c. Work shall be in full conformance with all regulations for the physically handicapped in accordance with ANSI Publication No. A-117.1 Part 4, Series 4.12, Design of Barrier-Free Facilities, the recommendations of United States Department of Justice, N° 28 CFR Part 36 - American with Disabilities Act Public Law 101-336, (referred to herein as "ADA"), local authorities, and all other governing bodies which may have jurisdiction.
 - d. Products requiring electrical connection: Listed and classified by Underwriter's Laboratories, Inc., as suitable for the purpose specified and indicated.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. Fume hoods shall be of complete airfoil design to insure maximum operating efficiency. Foil sections at the front fascia of the hood shall minimize eddying of air currents at the hood face and the rear baffle system shall minimize turbulence in the upper portion of the hood interior.

2.4 MATERIALS

- A. Exterior Metal: Manufacturer's standard with acid-resistant and alkali-resistant, baked-on finish. Provide in color as selected by Architect from manufacturer's standard range of available colors.
- B. Stainless Steel: AISI Type 302/304 with No. 4 finish.
- C. Laminated Safety Glass: Two sheets of clear float glass, complying with ASTM C 1036 requirements for Type I, Class I, Quality q3 glass, permanently laminated to clear polyvinyl butyral interlayer.

2.5 FABRICATION

- A. General: Design hoods to be highly fume resistant, to collect, retain and dispose of hazardous fumes with complete safety, minimum purging of air from room supply, and minimum turbulence within hood chamber.
 1. Provide fume hoods with all service fittings loose for installation in base cabinets below by other trades.
- B. Provide airfoil vane at bottom to match configuration of side sections. Mount foil with 1-inch open space between foil and bottom front edge of hood superstructure

to prevent backflow of air and to direct positive flow of air across work surface. Extend airfoil under sash line, so that sash closes on top of foil.

- C. Superstructure Framework: Freestanding heavy gage steel members, reinforced, braced and assembled to insure strength and rigidity and to support exterior panels, interior liner, and baffle panels.
 - 1. Superstructure shall allow for exterior and interior liner panels to be removable without disassembly of the frame structure or adjacent panel assemblies.
- D. Body Construction: Fabricate exterior of minimum 18-gage cold-rolled steel with component parts screwed together to allow removal of end panels, front-end fascia pieces, top fascia and airfoil strips, and to allow access to plumbing lines and service fittings. Apply manufacturer's standard acid- and alkali-resistant, baked-on finish to interior and exterior surface of component parts prior to final assembly.
- E. Interior walls: Double-wall end panels without projecting corner posts or other obstructions to interfere with smooth, even flow of air. Close area between double walls for housing sash counter-balance weights, utility lines, and remote-control valves. Fascia section shall have a full 135 degree 1 inch radius at the front leading edge or equivalent configuration to provide a streamlined section and insure smooth even flow of air into the hood. Vertical fascia shall contain the required service controls, electrical switches and receptacles. The hood interior end panels and sash track shall be flush with the fascia to prevent eddy currents and back flow of air.
 - 1. Provide fully finished rear panel in all fume hoods
- F. Airfoil: Streamlined, removable, airfoil fabricated from 12 gage steel integral to the bottom of hood opening providing a nominal 1 inch open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The airfoil shall extend back under sash, to prevent sash from closing opening. Airfoil shall be removable to allow large equipment into the hood.
- G. Fume hood top panel: Manufacturer's standard grille bypass configuration. Top front panel shall be of the same material as the exterior fascia with an integral grille stamped into the upper portion.
 - 1. Provide ceiling enclosure panel matching construction and finish of superstructure; scribed to ceiling.
- H. Fume hood lighting: UL listed one-tube, energy-efficient, T-5 fluorescent light fixture in the hood roof providing minimum illumination at 13 inches above the work surface of 100 foot-candles. Shield light fixture from hood interior with 1/4-inch-thick laminated safety glass or 1/8-inch-thick tempered-glass panel, sealed airtight into hood body with chemical-resistant rubber channels. Set units so that fluorescent tubes are easily replaceable from outside hood.
- I. Fume hood sash: Vertical rising sash of ¼ inch laminated safety glass in a single slotted sash track. Sash shall have a neutral colored polyvinyl chloride horizontal member at the top and a full-length metal handle at the bottom. The sash track shall be a neutral colored polyvinyl chloride set flush with the interior liner panels to minimize turbulence.

1. Counterbalance vertical sliding sash with sash weight and cable system. Provide stainless steel or monel metal cable, ball-bearing sheaves, plastic glides in stainless steel guides, and stainless steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.
 2. Provide manufacturer's standard safety label on sash.
 3. Provide manufacturer's factory installed sash locks at all fume hoods.
- J. Fume hood lining: Use epoxy resin for exposed interior surfaces. Use stainless steel for fasteners and other exposed metal. Furnish end panels, back panel, and top of not less than 1/4-inch-thick material, screwed together with cleats or steel angles to form a completely rigid assembly to which exterior cold-rolled steel panels are mounted.
1. Back up joints with angles or cleats and coat joints with chemical-resistant mastic before assembly to prevent open joints or spaces. Use stainless steel truss-head screws or rivets (not countersunk) for assembly of panels and to provide maximum strength joints. Secure hood baffle to cleats at rear of hood with stainless steel screws.
 2. Punch hood side panels to receive remote controls and service fittings at side of hood, as indicated. Furnish removable plug buttons for holes not used for indicated fittings.
 3. Liner Panel Performance Tests: Chemical Spot Tests at 24 Hours:
 - a. Chemical spot test shall be made by applying 10 drops (approximately 1/2 cc) of each reagent to the surface to be tested. Each reagent (except those marked **) shall be covered with a 1-1/2 inch diameter watch glass, convex side down to confine the reagent. Spot tests of volatile solvents marked ** shall be tested as follows: A 1-inch or larger ball of cotton shall be saturated with the solvent and placed on the surfaces to be tested. The cotton ball shall then be covered by an inverted 2-ounce, wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire 24-hour test period and at a temperature of 77 degrees F. + 3 degrees F.
 - b. At the end of the test period, the reagents shall be flushed from the surfaces with water and the surface scrubbed with a soft bristle brush under running water, rinsed, and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Spots where dyes have dried shall be cleaned with a cotton swab soaked in alcohol to remove the surface dye. The test panel shall then be evaluated immediately after drying.
 - c. Ratings/Legend:

Modified Epoxy Resin	A = No effect or slight change in gloss
	B = Slight change in gloss or color
	C = Slight etching or severe staining
	D = Swelling, pitting, or severe etching
 - d. RESULTS:

Acetic Acid	98%	A
Acetone	**	A
Acid Dichromate		A
Ammonium Hydroxide	** 28%	A

Amyl Acetate **		A
Benzene **		A
Butyl Alcohol **		A
Carbon Tetrachloride **		A
Chloroform **		A
Chromic Acid	60%	B
Cresol		A
Dichloroacetic Acid		A
Dimethylformamide		A
Dioxane **		A
Ethyl Acetate **		A
Ethyl Ether **		A
Ethyl Alcohol **		A
Formaldehyde		A
Formic Acid	90%	A
Furfural **		B
Gasoline **		A
Hydrochloric Acid	37%	A
Hydrofluoric Acid	48%	B
Hydrogen Peroxide	30%	A
Methyl Ethyl Ketone **		A
Methyl Alcohol **		A
Methylene Chloride **		A
Monochlorobenzene **		A
Naphthalene **		A
Nitric Acid	20%	B
Nitric Acid	30%	B
Nitric Acid	70%	B
Phenol **	85%	A
Phosphoric Acid	85%	A
Silver Nitrate		B
Sodium Hydroxide	40%	A
Sodium Hydroxide	20%	A
Sodium Hydroxide	10%	A
Sodium Hydroxide Flake		A
Sodium Sulfide		A
Sulfuric Acid	77%	A
Sulfuric Acid	96%	C
Sulfuric Acid	33%	A
Tincture of Iodine		A
Toluene **		A
Trichlorethylene **		A
Xylene **		A
Zinc Chloride		A
Nitric 70%/Sulfuric Acid	77%*	B

- * Equal parts of Nitric Acid 70% and Sulfuric Acid 77%.
- ** Indicates these solvents tested with cotton and jar method

- K. Working Surface: Minimum 1 inch-thick molded epoxy resin working surface with marine edge to form a watertight pan not less than 3/8 inch deep and with a 6 inch wide safety ledge along the front edge. Provide manufacturer's standard epoxy resin cup drain flush with recessed work surface.
- L. Baffle: Provide a removable baffle at rear of hood with adjustable openings at top and bottom to allow adjusted flow of air through hood to compensate for type of apparatus, or heat source used. Fabricate unit to be easily removable for cleaning behind baffle, of same material as hood lining.
 - 1. Provide control adjustment strips at top and bottom with plastic or stainless steel knobs.
- M. Plenum Chamber: Adequate volume for hood dimensions, extending full width of hoods to equalize incoming airflow, of same material as hood lining. Provide corrosion-resistant, duct stub of proper dimension for connection to exhaust duct assembly.
- N. By-Pass Grilles: When air is required to be taken from room other than through hood sash opening, provide suitable by-pass grilles having the required free opening but concealing plenum behind.
- O. Plumbing: Plumbing fit out shall consist of remote control valves located within the end panels, controlled by extension rods projecting through the control panels of the hood, with color coded plastic handles. Interior fitting for gases and water shall be nylon panel flanges and angle serrated hose connectors, color-coded. Interior fittings for distilled water shall consist of a bronze tin lined, white color-coded, panel flange and angle serrated hose connector. Interior fittings for steam shall consist of a cast bronze flange and angle serrated hose connector with a chemical resistant metallic bronze finish. Water goosenecks shall be cast bronze with a chemical resistant metallic bronze finish. All plumbing fittings shall be factory installed and piped between the valve and the outlet. Inlet piping shall have a single-point connection for each valve provided and carried to a point 1 inch above the fume hood roof or 1 inch above the worktop rear corner depending on the rough-in locations shown in the drawings. Points of final service connection by other trades shall be at the stub provided by the fume hood manufacturer.
- P. Fume hood alarm system: Fume hoods shall be provided with an electronic alarm system to detect low hood face velocities. The alarm system shall sense the actual face velocity of the hood regardless of sash position. The system shall have air velocity sensing thermistor located in the monitor on the face of the hood. The monitor shall have a green light activated when the face velocity is above the set point and a red light and audible alarm that are activated when the face velocity is below the set point. The audible alarm can be acknowledged and silenced with mute switch on panel. When the mute is activated, it automatically resets itself when face velocity again rises above calibrated set point. The set point is to be factory set and calibrated at approximately 70 FPM. Field calibration is possible with adjustment of recessed zero potentiometer on front of unit. Air flow is shown as a multi-light display column or as LED digital display.

- Q. Closure Strips: Metal to match adjoining surfaces. Provide where required to close openings between fume hood base cabinet and superstructure and adjacent building wall construction.
- R. Holes: Provide holes for passage of piping and conduit and for fittings furnished under other Division 12 Sections.
- S. Fasteners: Provide stainless steel fasteners wherever exposed to fumes in hood.

2.6 FINISHES

- A. Assembled fume hood components shall be given a pre-paint treatment for adhesion of the final finish system and to aid in the prevention of corrosion due to humidity or presence of chemicals. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine-grained crystalline phosphate surface.
- B. After pre-paint treatment has fully cured provide all steel surfaces with a chemical and corrosion resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance.

2.7 FINISH PERFORMANCE TESTING:

- A. Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4 inch diameter watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2 ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of $77^{\circ} \pm 3^{\circ}$ F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.
- B. Test results:
 - 1. Level 0 - No detectable change.
 - 2. Level 1 - Slight change in color or gloss.
 - 3. Level 2 - Slight surface etching or severe staining.
 - 4. Level 3 - Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.
- C. Test results: After testing, panel shall show no more than three (3) Level 3 conditions.
- D. Test Reagents (Where concentrations are indicated, percentages are by weight):

Chemical Reagent	Test Method
Acetate, Amyl	Cotton ball & bottle
Acetate, Ethyl	Cotton ball & bottle
Acetic Acid, 98%	Watch glass
Acetone	Cotton ball & bottle
Acid Dichromate, 5%	Watch glass
Alcohol, Butyl	Cotton ball & bottle
Alcohol, Ethyl	Cotton ball & bottle
Alcohol, Methyl	Cotton ball & bottle
Ammonium Hydroxide, 28%	Watch glass
Benzene	Cotton ball & bottle
Carbon Tetrachloride	Cotton ball & bottle
Chloroform	Cotton ball & bottle
Chromic Acid, 60%	Watch glass
Cresol	Cotton ball & bottle
Dichlor Acetic Acid	Cotton ball & bottle
Dimethylformamide	Cotton ball & bottle
Dioxane	Cotton ball & bottle
Ethyl Ether	Cotton ball & bottle
Formaldehyde, 37%	Cotton ball & bottle
Formic Acid, 90%	Watch glass
Furfural	Cotton ball & bottle
Gasoline	Cotton ball & bottle
Hydrochloric Acid, 37%	Watch glass
Hydrofluoric Acid, 48%	Watch glass
Hydrogen Peroxide, 3%	Watch glass
Iodine, Tincture of	Watch glass
Methyl Ethyl Ketone	Cotton ball & bottle
Methylene Chloride	Cotton ball & bottle
Mono Chlorobenzene	Cotton ball & bottle
Naphthalene	Cotton ball & bottle
Nitric Acid, 20%	Watch glass
Nitric Acid, 30%	Watch glass
Nitric Acid, 70%	Watch glass
Phenol, 90%	Cotton ball & bottle
Phosphoric Acid, 85%	Watch glass
Silver Nitrate, Saturated	Watch glass
Sodium Hydroxide, 10%	Watch glass
Sodium Hydroxide, 20%	Watch glass
Sodium Hydroxide, 40%	Watch glass
Sodium Hydroxide, Flake	Watch glass
Sodium Sulfide, Saturated	Watch glass
Sulfuric Acid, 33%	Watch glass
Sulfuric Acid, 77%	Watch glass
Sulfuric Acid, 96%	Watch glass

Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
Toluene	Cotton ball & bottle
Trichloroethylene	Cotton ball & bottle
Xylene	Cotton ball & bottle
Zinc Chloride, Saturated	Watch glass

- E. Performance Test Results (Heat Resistance):
1. Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.
- F. Performance Test Results (Impact Resistance):
1. A one-pound ball (approximately 2 inches diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye ball examination.
- G. Performance Test Results (Bending Test):
1. An 18 gauge steel strip, finished as specified, when bent 180° over a 1/2" diameter mandrel, shall show no peeling or flaking off of the finish.
- H. Performance Test Results (Adhesion):
1. Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16 inch apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination.
- I. Performance Test Results (Hardness):
1. The test sample shall have a hardness of 4H using the pencil hardness test.
 2. The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel like manner until one is found that will cut or scratch the film. The pencil used before that one that is, the hardest pencil that will not rupture the film is then used to express or designate the hardness.

2.8 ACCESSORIES

- A. Service Fittings: Manufacturer's standard heavy-duty, chrome plated finish over brass. Type, configuration and location of fittings are shown on Drawings.
- B. Airflow Alarm: Provide fume hoods with audible and visual alarm that activates when airflow sensor reading is outside of preset range.
1. Provide with either thermal-anemometer or aneroid gage airflow sensor.
 2. Provide with reset and test switches.

3. Provide with switch that silences audible alarm and automatically resets when airflow returns to within preset range.
- C. Sash Alarm: Provide fume hoods with audible and visual alarm that activates when sash is opened beyond preset position.
 1. Provide with silence and test switches.
- D. Sash Stops: Provide fume hoods with sash stops to limit hood opening to 50 percent of sash height. Sash stops can be manually released to open sash fully for cleaning hood and for placing large apparatus within hood.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fume hoods plumb, level, aligned, rigid, and securely anchored to building and adjacent laboratory casework, in proper location, in accordance with manufacturer's instructions and approved shop (layout) drawings. Install closures neatly. Securely attach access panels, but provide for easy removal and secure reattachment.
- B. Coordinate sequence of work with mechanical and electrical trades and with related work such as laboratory casework specified in Section 12 30 00 – CASEWORK.

3.2 FIELD QUALITY CONTROL

- A. Field Test: Field test each unit after completion of installation to verify proper operation of hoods.
- B. Field test hoods according to fume hood standard after completing installation to demonstrate proper operation. Also test one hood selected by Architect, for each type of hood installed, according to ASHRAE 110 to verify performance. If any hood tested for performance fails to perform as specified, field test additional hoods as directed by Architect.
 1. Adjust fume hoods, hood exhaust fans, and building's HVAC system, or replace hoods and make other corrections until tested hoods perform as specified.
 2. After making corrections, retest fume hoods that failed to perform as specified.

3.3 ADJUST AND CLEAN

- A. Moving Parts: Carefully check and adjust moving parts to insure smooth, near-silent, and accurate sash operation with one hand and with uniform contact of rubber bumpers. Ensure counter-balances operate without interference.
- B. Clean surfaces including both sides of glass.
- C. Damaged Work: Repair equal to new undamaged work, or replace with new units, as acceptable to Architect.

End of Section

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Section 11 57 00
VOCATIONAL SHOP EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies vocational technology equipment including the following:
1. Paint spray hoods.

1.2 RELATED REQUIREMENTS

- A. Division 23 – HVAC: Providing ducting and exhaust for vocational shop equipment
- B. Division 26 – ELECTRICAL: Providing power and conduit to vocational shop equipment

1.3 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, illustrations, specifications, performance data, for each item furnished hereunder.
 - a. Detailed written technical specifications for the materials, fabrication and finishing of the specified item(s).
 - b. Provide installation instructions for all equipment.
 2. Maintenance and service instructions.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver equipment to the project until all concrete, masonry, plaster and other wet work has been completed and dry.
- C. Deliver and store equipment in original, sealed packaging showing manufacturer's identification and model number.
- D. Protect equipment from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.

1.5 WARRANTY

- A. Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
- B. In addition to the specific guarantee requirements of the GENERAL CONDITIONS and SUPPLEMENTAL GENERAL CONDITIONS, the Contractor shall obtain in the Owner's name the standard written manufacturer's guarantee of all materials furnished under this Section where such guarantees are offered in the manufacturer's published product data. All these guarantees shall be in addition

to, and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 PAINT SPRAY HOODS:

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on MacMaster-Carr Model No. 7866T83; full size spray booth, 36 inch width.
 - 1. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. MacMaster-Carr, Robbinsville, NJ.
 - b. Eagle Equipment, Greensboro NC
 - c. Sentry Air Systems Inc., Cypress TX.
- B. Characteristics:
 - 1. Booth inside dimensions: 24 inches deep by 36 inch width and 48 inches high. Fabricated from galvanized steel.
 - 2. Exhaust: 208 volt, 3-phase AC exhaust motor, hardwired and UL listed.
 - 3. Booths shall come with 20 by 20 inch polyester filters that meet UL 900 for flame retardance, filter frames, and provided with a filter change indicator.
 - 4. Booths shall conform to OSHA and NFPA regulations.
 - 5. Booths shall have a 1/3 HP motor that operates on 230 volts AC and draws 1.5 amps.
 - 6. Airflow: 1,200 cfm.
 - 7. Exhaust fan duct diameter shall be 12 inch
 - 8. Provide three sets of replacement filters for each booth

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.
- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

3.2 PREPARATION

- A. Examine workshop equipment and ensure no defects are present. Do not install damaged equipment.

3.3 INSTALLATION

- A. Install each piece of equipment in accordance with manufacturers' instructions.
 - 1. Maximum variation for installed equipment, from true position of 1/16 inch in 8 feet for plumb and level and a maximum of 1/32 inch offsets in adjoining surfaces intended to be flush.
- B. Locate equipment where indicated on the Drawings. Where applicable, permanently secure to building construction.
 - 1. Anchor equipment using devices appropriate for equipment, substrate and expected usage.
- C. Sequence installation and erection to ensure correct electrical utility connections are achieved.
 - 1. Connect to power and test operation.

3.4 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00 - EXECUTION.
- B. Adjust equipment to ensure proper working order and conditions.
- C. Remove and replace equipment creating excessive noise, or vibration.
- D. After installation is completed, insure that operating parts work freely and fit neatly. Replace damaged parts, dents, buckles, abrasions, scraps or other damage affecting the appearance or serviceability.

3.5 CLEANING

- A. At completion of each work day, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.
- B. Upon completion of the work of this Section, remove tools and all crating boxes, coverings, rubbish and debris from the work area; leave area in broom-clean condition.
- C. Remove protective coverings from equipment just prior to Owner's acceptance of facility.
- D. Clean equipment under provisions of Section 01 73 00 - EXECUTION:
 - 1. Wash and clean equipment.
 - 2. Clean and polish glass, plastic, hardware and accessories, fixtures and fittings.

End of Section

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Section 11 61 33
THEATRICAL RIGGING

PART 1 - GENERAL

1.1 SUMMARY

Theatrical rigging includes equipment assemblies, systems and components required for locating scenic, acoustic, lighting and masking elements in variable vertical planes within the performance space.

A. Section Includes:

1. Work in the following space:
 - a. Auditorium
2. Provide systems including:
 - a. Motorized House Curtain with Traveler Track and Associated Rigging and Local Controls
 - b. Motorized Front of House Lighting Hoists and Local Controls
 - c. Motorized over stage battens and lighting bars with cable and a cable management system
 - d. Motorized Theatrical Rigging Control System
 - e. Performance Traveler Tracks
 - f. Miscellaneous Rigging Equipment
3. Additional support structures as required to meet the intent of the Contract Documents
4. Provision of materials, components, modifications, assemblies, equipment and services as specified herein. These include, but are not limited to:
 - a. Verification of site dimensions and conditions
 - b. Submittals as required by the Contract Documents
 - c. Submission of Shop Drawings performed, signed and sealed by a Professional Engineer experienced in work of similar nature and scope, and licensed to practice by the appropriate governing authority in the state in which the Work is manufactured.
 - d. Design and engineering of equipment and systems as required by the Contract Documents
 - e. Manufacture of equipment and systems as required by the Contract Documents
 - f. Scheduling, sequencing and coordination with other trades
 - g. Site supervision of equipment and systems installation specified herein and elsewhere in the Contract Documents
 - h. Testing and demonstration of equipment and systems as specified herein and elsewhere in the Contract Documents
 - i. Record Drawings and Operations and Maintenance Manuals (O&M)
 - j. Instruction to Owner

5. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.
- B. Products Supplied But Not Installed Under This Section – NOT USED
- C. Products Installed But Not Supplied Under This Section:
 1. Stage Drapery as fabricated under Section 11 61 43: Theatrical Draperies
- D. Related Sections:
 1. Division 5: Metals
 2. Division 9: Finishes
 3. Division 11: Equipment:
 - a. Section 11 61 43: Theatrical Draperies
 4. Division 26: Electrical:
 - a. Section 26 00 00: Electrical Requirements
 - b. Section 26 61 11: Theatrical Lighting Controls
- E. Allowances – Not used
- F. Unit Prices – Not used
- G. Measurement Procedures – Not used
- H. Payment Procedures – Not used
- I. Alternates – Not used

1.2 REFERENCES

- A. American Institute of Steel Construction (AISC) Manual of Steel Construction
- B. American Welding Society (AWS) Code for Welding
- C. American National Standards Institute (ANSI)
- D. American Society for Testing and Materials (ASTM)
- E. National Electrical Manufacturers Association (NEMA)
- F. National Fire Protection Association (NFPA) National Electric Code (NEC)
- G. Underwriters Laboratories (UL)

1.3 DEFINITIONS – NOT USED

1.4 SYSTEM DESCRIPTION

- A. The following establishes minimum safety requirements for the system. Where federal, state and local legislation address these topics, the more stringent requirements shall take precedence. Factors listed below in no way relieve the Contractor from the sole responsibility of providing safe systems.
- B. Performance Requirements:
1. Provide design compliant with ANSI E1.4 Manual Counterweight Rigging Systems.
 2. Provide design compliant with ANSI E1.6-1 Powered Hoist Systems.
 3. Provide electrical devices and components that are NEMA and UL approved for the applications. Perform wiring and electrical service by a licensed electrician. Conform to applicable codes.
 4. Provide materials that are new, unused, and of the latest design.
 5. Minimum design factor for lifted loads: 8:1
 - a. Design factor shall include the effects of static loads, dynamic impact loads, and reductions for end terminations and bending ratios.
 - b. Include dynamic impact loads in the design of all components. The minimum impact factor may be assumed as 33 percent of the static load. Alternately, the Contractor may calculate the impact factor based on the selected hoist components, loads, and hoist speeds. Submit calculations for approval by the Theatre Consultant. The calculations shall include the effect of an emergency stop while lowering the load at maximum speed. In no case may the impact factor be less than 15 percent of the static load.
 - c. Increase the design factor for ropes where normal operating loads include cyclic dynamic loads to suit the system operational requirements for required service life.
 6. Minimum design factor for static loads: 8:1
 7. Cable bending ratio:
 - a. Manually operated systems: Cable diameter x 25
 - b. Motorized systems: Comply with wire rope manufacturer's minimum recommended bending ratio for the style and grade of wire rope.
 8. Maximum Fleet Angle: 1.5 degrees
 9. Gear motors: Minimum Class B insulation, totally enclosed fan ventilated (TEFC)
 10. Gear motor reducers: AGMA load classification of 1 and minimum mechanical service factor of 1.25
 11. Gear motor brakes: Minimum retarding torque equal to 200 percent of the motor full load torque.
 12. Bearings: Two (2) times required load at full speed for 2000 hours.

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- C. Provide assemblies, cable components, connections, equipment, hardware and linkages employed in supporting, in whole or in part, overhead loads that are rated and designed for that application. Base loading for each component on the maximum percentage of the capacity of the set in which the component is employed. For design purposes, base the minimum set capacity on the batten length multiplied by a thirty (30) pound per linear foot (plf) load unless indicated otherwise herein.
 - D. Provide mule blocks, rollers and guides as required to provide proper alignment and maintain allowable fleet angles.
 - E. Do not substitute cast iron components for arbor top and bottom members and clamps for attaching loft and head blocks to the support structure.
 - F. Provide systems designed to reflect industry standard safeguards and precautions related to normal use of the equipment under ideal operating and loading conditions.

1.5 SUBMITTALS

- A. Product Data – Not used
- B. Shop Drawings:
 - 1. Provide Submittals in accordance with Division 1. Submit in a timely manner, allowing sufficient time for adequate review and possible resubmittal without jeopardizing the project schedule.
 - 2. Submit Shop Drawings within ninety (90) days of award of contract.
 - 3. Provide complete Submittals. No partial Submittals shall be allowed.
 - 4. Drawings will show all information necessary to explain fully the design features, appearance, function, fabrication, installation and use of system components in all phases of operation.
 - 5. Make engineering studies, calculations, models, and reports part of the Shop Drawing Submittal.
 - 6. Fabrication, installation and erection shall not commence until Shop Drawings have been reviewed and marked by the Theatre Consultant.
 - 7. All sheets in the Submittal shall be of the same size.
 - 8. Submittal shall have a title sheet listing included sheets.
 - 9. Submission of Shop Drawings performed, signed and sealed by a Professional Engineer experienced in work of similar nature and scope, and licensed to practice by the appropriate governing authority in the state in which the Work is manufactured.
- C. Samples
 - 1. Provide labeled samples of components and materials in a reasonable size to serve review process. Provide a minimum of two (2) identical samples for each item requested. Submittal samples shall include, but are not limited to:
 - a. Traveler track operating rope
- D. Quality Assurance/Control – Not used
 - 1. Submittals – Not used
 - 2. Design Data – Not used

3. Test Reports, Certificates – Not used
 4. Manufacturers' Instructions – Not used
 5. Manufacturers' Field Reports – Not used
 6. Qualification Statements – Not used
- E. Closeout Submittals
1. Submit Record Documents in accordance with Division 1.
 2. Bind all O&M (Operations and Maintenance Manuals) documentation separate from general building sections so they can be turned over to the users after approval.
 3. Provide draft copy of completed manuals for review to the Theatre Consultant before the start of commissioning.
 4. Operations and Maintenance Manuals, in quantities of three (3), shall include:
 - a. Contact information for Theatre Equipment Contractor and pertinent manufacturers
 - b. Safety and Operational Instructions
 - c. Complete parts and subassembly list
 - d. Equipment design parameters such as safe working loads and duty cycles
 - e. Wiring diagrams and termination schedules
 - f. Periodic Maintenance Schedule
 - g. Maintenance procedures for finishes
 - h. Certificates of compliance with applicable codes
 - i. Records of final testing and log
 - j. Spare parts list and source information
 - k. Warranty documentation
 - l. In addition to the requirements referenced above, provide record copy Shop Drawings for archival and reference usage as part of the O&M manuals:
 - i. Reduced size, 11 inch by 17 inches preferred, hardcopy prints
 - ii. Universal electronic format files, .pdf file type is preferred, as full size printable sheets. Submit files on a USB clearly labeled including project name, project architect, theatre consultant, contractor name, date of submittal.
 5. Include diagrams depicting the system layout and maximum load limitations (drawn not less than 1/4 inch = 1'-0").
 6. Provide three (3) hard copies of all Shop Drawings, including any updates or revisions to the original submission.
 7. Provide the following electronic files:
 - a. Shop Drawings in their native electronic files (AutoCAD or similar)
 - b. All Submittal files, including Shop Drawings, in a Portable Document File (.pdf) format

1.6 QUALITY ASSURANCE

A. Qualifications

1. Contractor: A firm with a minimum of five (5) years' experience in the type of work required by this Section.
2. Installers: Skilled technicians who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and best industry practices for the proper installation of the Work.
 - a. Engage installation supervisors who have satisfactorily passed ETCP Rigging qualification tests for theatre and arena and are currently certified for these activities.

B. Regulatory Requirements – Not used

C. Certifications

1. Welding Standards: Comply with applicable provisions of AWS D1.1.
 - a. Engage welders who have satisfactorily passed AWS qualification tests for welding processes involved and are currently certified for these processes.
 - b. Provide a copy of welding certificates held by welders employed in the fabrication or installation of the Work upon request.

D. Field Samples –Not used

E. Mock-ups – Not used

F. Pre-installation Meetings – Not used

1.7 DELIVERY, STORAGE, AND HANDLING – NOT USED

A. Packing, Shipping, Handling, and Unloading – Not used

B. Acceptance at Site – Not used

C. Storage and Protection – Not used

D. Waste Management and Disposal – Not used

1.8 PROJECT CONDITIONS

A. Project Environmental Requirements – Not used

B. Existing Conditions – Not used

- ### C. Field Measurements: Verify all critical dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.9 SEQUENCING

- ### A. Coordinate Work in this section with other trades.

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- B. Coordinate with the General Contractor the construction of support and fixings for tracks, hangers and winch assemblies, provision of sleeves for operating lines, access panels, etc.
 - C. Coordinate with Division 26 provision of electrical supplies and conduit for control wiring.

1.10 SCHEDULING – NOT USED

1.11 WARRANTY

A. Special Warranty

1. Warrant systems and equipment to be free of defective components, faulty workmanship and improper adjustment for a period of two (2) years from the date of Owner's acceptance. Paint and exterior finishes are excluded relative to failure due to unusual exposure. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner. Rectify conditions that might present a hazard to human life, well-being and or property within forty-eight (48) hours of notification.
2. Designate warranties on manufactured equipment to the Owner to commence on the date of system acceptance.

1.12 COMMISSIONING – NOT USED

1.13 MAINTENANCE

A. Extra Materials:

1. Provide the following units as spares to be included in the base bid and turned over to the Owner at the time of system commissioning and training:
 - a. Unique test equipment for repair and maintenance of the motive and control systems
 - b. One (1) digital encoders of the type used in the systems
 - c. Three (3) direct strike limit switches of the type used in the system
 - d. One (1) electronic motor control cards of the type used in the system
 - e. One (1) electronic motor control power supplies of the type used in the system
2. Replace extra materials that are used during the warranty period so that the complete specified inventory is available throughout the warranty period.

B. Maintenance Service:

1. Provide maintenance service for a period of one (1) year after final acceptance of the installation. This service consists of at least two (2) half-yearly visits to the site for checking and adjusting of equipment. Perform the first visit six (6) months after the system has been accepted. Arrange visit to be at a time mutually agreeable to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Provide the rigging systems from components (except where otherwise stated) that are the products of one of the following manufacturers:

1. J.R. Clancy, Inc., Syracuse, NY
2. ETC Rigging, Middleton, WI
3. De Sisti Rigging and Automation, North Bergen, NJ
4. Texas Scenic Company, San Antonio, TX

B. Provide tracks and operating devices that are products of one of the following manufacturers:

1. Atlas Silk Division, H&H Specialties Inc., City of Industry, CA
2. Automatic Devices Co. (ADC), Allentown, PA
3. Tru-Roll Inc., Glendale, CA
4. I. Weiss & Son, Fairview, NJ - 201-402-6500

2.2 EXISTING PRODUCTS – NOT USED

2.3 MATERIALS

A. Materials shall conform to the following ASTM and ANSI standard specifications:

1. Structural steel shapes and plate: A36
2. Steel tube: A500
3. Malleable iron casting: A47
4. Gray iron casting: A48

B. Fasteners:

1. Comply with ANSI B18.2.1&2 Specification for square and hex bolts and nuts.
2. Bolts and fasteners shall be grade 5 or better.
3. Fasteners shall be rated for the anticipated loads.
4. Provide fasteners with approved markings indicating their rating.

C. Electrical and Control Components:

1. Comply with the requirements of the NFPA National Electric Code.

2.4 MANUFACTURED UNITS

A. Motorized Rigging Systems over stage and Front of House (FOH):

1. General:
 - a. Provide system designed for the fixed or variable speeds as specified herein.
 - b. Verify all dimensions and mounting requirements necessary to complete the Work. Provide all secondary supporting steel work as necessary.
 - c. Hoist shall be integrated into the lifted component and be self-climbing in nature.
 - d. Brake/motor/gear unit to be from single manufacturer and to be generously sized for application.
 - e. Brakes shall be spring applied and electrically released. Brake shall apply a minimum retarding torque equal to 125 percent of motor full load torque.

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- f. Overspeed mechanisms shall be provided capable of detecting a runaway condition and applying a load arresting device.
 - g. Provide electric gear motors coupled to a cable drum. The drum design shall prevent wire rope from tangling or crossing over itself. Each drum shall accommodate two, 1/8" diameter 7 x 19 galvanized aircraft wire rope lift lines.
 - h. Provide motors with high inertia brake fans unless otherwise noted.
 - i. Winch duty cycle to be a minimum of five (5) complete cycles followed by thirty (30) minutes rest.
 - j. Provide the hoist on an integrated frame, completely enclosed with appropriate drip pans and access panels for maintenance. Enclosure shall not interfere with the operation of the hoist or any other system.
 - k. Winch unit shall operate smoothly and quietly without any rattles, squeaks, or vibration apparent at any time.
 - l. All transmission couplings from motor unit through to drums to be keyed and of ample torque capacity.
 - m. Transmission couplings and bearings shall be self-aligning type to address installation and field conditions.
 - n. Base mounting frame to be of substantial and rigid steel construction, with suitable provision for fixing to building framing.
 - o. Confirm that methods of anchoring and loads are acceptable to project Structural Engineer.
 - p. Provide and install all auxiliary mounting steel, attachments, hangers, bracing and anchors to attach the dual Lift lines to structure.
 - q. Winch unit to be completely pre-assembled and pre-wired in factory and tested before delivery to site.
 - r. Guard all moving or vulnerable parts of winch. Provide guards of sufficient strength to withstand everyday abuse, including standing or sitting on, without damage or deformation. Guards shall not interfere with operation of winch unit. Guards shall not rattle or vibrate. Attach guards securely, but ensure they are readily removable for maintenance purposes. Guard shall have no sharp corners or edges.
 - s. Determine the diameter and classification of wire rope construction to suit the lift line operational requirements.
 - t. Employ continuous lines from the same spool/length, free of knots, splices or mechanical fasteners along their length unless specifically required otherwise in the Contract Documents. Do not employ damaged or deformed cables.
2. General Controls:
- a. Unless otherwise noted, control and monitoring shall be accomplished with devices that are factory pre-wired and mounted on the winch base frame. Provide control and monitoring equipment local to the winch to ensure that it will meet the performance criteria stated herein.
 - i. Provide Control devices; fixed speed motor starters, variable speed frequency drives, and vector drives, brake contactors, line contactors, and other devices as indicated. Control devices shall respond to output signals.

- ii. Provide Feedback devices; Limit Switches, Positioning devices, Brake Status, and other devices as indicated. Feedback devices shall send input signals.
 - iii. Provide Alarm signals; Slack Line, Overtravel, Fault, and other faults as indicated. Faults shall send alarm signals.
 - iv. Provide suitable junction boxes, terminal strips, and other related hardware for connection of wires to carry these signals.
 - v. Provide additional equipment as required to meet the intent of the Contract Documents.
- b. Where indicated, or where specific equipment design precludes the mounting of control and/or monitoring devices to the base frame, such as direct strike limit switches, run all remote signals back to the primary control and monitoring location for each piece of equipment, such that there is one point of interface between each winch or group of winches and the performance control in system.
- c. Provide Local Controls for use in installation, service and maintenance.
- i. Provide control operators as part of motor starter or drive cabinets mounted to base frames.
 - ii. Provide "Local"/"Remote" key switch.
 - iii. Provide deadman style pushbuttons for each direction of movement. Label each button to clearly indicate its function.
- d. Local Mode Limit Devices:
- i. These devices shall function in both Local and Remote modes, regardless of the status of the Performance Control System.
 - ii. Provide end of travel limits for all devices. Utilize rotary limits unless otherwise noted.
 - iii. Provide overtravel limits for all devices. Utilize rotary limits unless otherwise noted. Configure overtravel limits to open a line contactor in the machine's motor controller.
 - iv. Where several devices are to be moved sequentially, provide enabling limits to permit motion only in the prescribed sequence and ranges.
- e. Rotary Limit Switches: Provide heavy-duty rotary limit switches coupled to the output shaft of the reducer. Key and pin roller chain sprockets and shaft couplings to shafts. Provide removable covers and chain guards on all limit switch assemblies.
- f. Slack Line Detectors: Provide heavy-duty normally closed type limit switches triggered by a deflector arm set on a lift line. Provide adjustment in deflector arm to allow for adjustment in the degree of slack that will trigger the switch and eliminate nuisance tripping.
- g. Position Transducer: Provide robust, industrial grade positioning sensor, such as an incremental positioning encoder in a sealed housing. Select an encoder easily capable of reporting to the control system with the positioning accuracy of the winch it is to be mounted.
- h. Provide motor control cabinets with safety disconnects adjacent to electric gear motors or as indicated in the Drawings.
- i. All key switches shall be unique with the option for master key enabling.
3. There shall be rear illuminated motor selection buttons. Buttons shall remain illuminated until de-selected.

4. Up to four motors may be selected to move at one time. When the up or down button is pushed and held, each motor shall move to its next stop location. If the stop location is the adjustable preset, the motor can be made to continue to travel in the selected direction by releasing and re-pressing the up or down hold-to-operate button until the next stop for the motor(s) is reached.
5. A maximum of four motors may move at one time and only in one direction at a time.
 - a. Pendant:
 - i. Provide a handheld pendant control to operate hoists. Pendant shall be equipped with a hoist selector switch and shall limit control to one hoist in operation at any time. The operator shall have to press one of several physical buttons to allow movement of any machine.
 - ii. Provide an enable switch that must be held to enable pendant usage.
 - iii. Provide pendant with 50 feet of flexible cable with strain relief attached.
 - iv. Provide Pendant Receptacles in the face of main control unit.
 - b. Emergency Stop System:
 - i. Provide an emergency stop system that is a hard wired, normally closed system connecting all devices.
 - ii. Provide mushroom type illuminated switch, engraved faceplate, wiring and containment in locations adjacent to moving equipment and pendant receptacle locations. A depressed switch shall mechanically latch into place. The switch may be reset by twisting or pulling the switch.
 - iii. The emergency stop system shall be a multiple wire system such that it meets the requirements described herein.
 - iv. Activating the emergency stop system shall stop and prevent further motion by all equipment controlled under this section and equipment in other separately controlled Sections.
 - v. An engaged emergency stop button shall extinguish all other stations and flash until reset.
 - vi. Basis of design:
 - a. ETC Prodigy Fly Pipe with Quick Touch Controller and pendant
 - b. Or approved equal
6. Hoist Power And Control Cables:
 - a. Each Drive Section shall include a power cord and Cat 5e (or better) hard-wired to the hoist with bare ends for field termination. Inclusion of a 20 amp 3-phase breaker in the junction box is optional. If the power and control cables terminate in the same enclosure, the wiring and optional connectors shall be incorporate a barrier between high and low voltage components. Proper strain relief at the Drive Section shall be provided.
7. Cable Management
 - a. Supplied motor power and control wiring shall be fed to the motor control enclosure by multi-conductor SO cable and Cat 5e (or better) cable. Each cable shall be held in place at the enclosure by means of a dedicated strain relief assembly.

- b. Lighting circuits and data wiring shall be fed to a standard raceway as shown in TL series drawings by multi-conductor SO cable. The SO cable shall be held in place at both ends by means of a dedicated strain relief assembly.
 8. Power And Control Distribution
 - a. The hoist and hoist cable management system shall allow for the attachment of a dedicated circuit and data distribution raceway.
 - b. The power/distribution raceway shall be UL Listed for this application.
 - c. Cable and cable management provided under this contract. Raceway provided under Div 26.
- B. House Curtain Bi-Part Winch
1. Provide winch system as indicated in the drawings. Size winches and components in the system for the house curtain load of up to 500 pounds.
 2. Provide winch with the following features:
 - a. Provide winch speed: fixed speed 90 feet per minute.
 - b. Provide Acceleration and Deceleration (Soft-Start).
 - c. Provide system travel accuracy: .02 feet.
 - d. Provide track mounted limit switches.
 - e. Provide winch with position limits and hold to run control.
 - f. Provide interlock-sensing devices with operable doors within this system.
 3. Provide and install winch mounting bases as indicated in the Drawings sized and connection to structure engineered for loads required. Provide cable muling, loft blocks as indicated and additional support structures as required.
 4. Provide wall mounted control station with open, close and e-stop buttons. Controls shall be hold to run.
 5. Basis of design:
 - a. Automatic Devices 2900 series machine
 - b. Or approved equal
- C. Traveler Tracks:
1. Tracks and accessories shall be provided from one manufacturer.
 2. Provide the tracks from 11-gauge extruded aluminum I beam shape in lengths up to 20 feet.
 3. Provide each track assembly from as few pieces as possible, free of burrs, dents and irregularities. Do not exceed 7'-0" on center for the maximum spacing of manufacturer's hanger supports.
 4. Provide the House Curtain Traveler Track Assembly of sufficient length to allow the curtain to travel clear of the maximum proscenium opening. See Drawings for schedule of sizes. Coordination is required for curtain tracks that are installed between side walls and acoustical panels and is the responsibility of this Section. Curved tracks shall be accurately formed with curves of constant radii and have smooth tangential transitions between sections of different radii.

5. Provide two (2) master carriers for each double-section of track. Provide each carrier with four (4) neoprene wheels fitted with ball bearings and paired so that two wheels ride in the track on either side of the carrier slot. Provide each carrier with two (2) clamps for attachment of 1/2inch operating cord and two plated swivels with a 6 inch trim chain for curtain attachment.
6. Provide single carriers with two (2) neoprene ball bearing wheels and a "hollow center" design to bypass the 1/2-inch operating line and prevent operating line sag. Provide carriers with single plated swivels with 6 inch trim chains. Provide one (1) single carrier for each 1'-0" of track length.
7. Provide tracks with end stacking (rear fold, back pack) devices to prevent on-stage "bunching" and provide drapery stacking only at offstage track ends.
8. Provide heavy-duty type end pulley blocks with 6-inch diameter sheaves turned and grooved to fit the 1/2-inch operating cord and fitted with sealed ball bearings. Provide blocks to retain the operating cord in sheave grooves. Provide double vertical sheaves on the live end of tracks and a single horizontal sheave on the dead end.
9. Secure housings to the track with bolts and locking washers.
10. Provide end stops and operating cord supports at the overlapping track ends to positively stop master carrier movement when the curtain is closed. Secure stops to the tracks and provide with rubber bumpers to reduce "stop noise."
11. Provide a floor pulley block with a 6 inch diameter sheave. Slot the side plates of the floor block to permit vertical adjustment of the sheave to remove up to 14 inches of slack in the operating line. Provide block with a locking handle to permit sheave adjustment without wrenches or other tools. Incorporate vinyl sand filled base to tension the block when track is raised and lowered.
12. Provide tracks, carriers, and other components as supplied from the manufacturer with a black finish on parts and accessories. Bright or natural finish on metal components will not be accepted.
13. Provide hardware not specified above but required to provide a properly operating system in accordance with the intent of the Contract Documents.
14. Basis of design
 - a. House Curtain Traveler Track:
 - i. H&H #516CB series track (black)
 - ii. ADC #500BL series track (black)
 - b. Stage Traveler Track:
 - i. Atlas Silk #400B series track (black)
 - ii. ADC #280 series track (custom black) - Automatic Devices Co. (ADC), Allentown, PA – 800-360-2321
15. Walk along drapery track:
 - a. Curtain tracks shall be of 11 gauge extruded aluminum I-beam construction consisting of a center rib and top, intermediate and bottom flanges.
 - b. Provide each track assembly from as few pieces as possible, free of burrs, dents and irregularities. Do not exceed 4'-0" on center for the maximum spacing of hanger supports.

-
- c. Provide two (2) master carriers for each drapery panel. Provide each carrier with four (4) nylon-tired, ball-bearing wheels. Provide each carrier with two (2) plated swivels for curtain attachment.
 - d. Provide single carriers with two (2) nylon-tired ball-bearing wheels. Provide carriers with single plated swivels. Provide one (1) single carrier for each 1'-0" of drape length.
 - e. Provide tracks, carriers, and other components as supplied from the manufacturer with a black finish on parts and accessories. Bright or natural finish on metal components will not be accepted.
 - f. Walk along traveler track (first leg):
 - i. Atlas Silk #300B series track (black)

D. Miscellaneous Rigging Equipment:

- 1. Batten extensions:
 - a. Provide pipe battens of 1-1/2 inch nominal Schedule 40 seamless black wrought steel pipe. Provide 24 inch long by 1-9/16 inch D.O.M. steel tube splice sleeve extending 12 inches into batten extension and held by two (2) 3/8 inch hex bolts and lock jam nuts.
 - b. Provide pipe battens clean and free from mill finishes, scale and rust and painted black.
 - c. Provide batten extensions in the length(s) depicted on the Drawings and schedules.
 - d. Provide welded tie rings at one end as shown on the Drawings.
- 2. Beam clamps:
 - a. Basis of design: JR Clancy (015-798) or approved equal
 - b. See schedule in Drawings for notes and quantities.
- 3. See schedule in the Drawings for loose equipment quantities to be provided.

2.5 EQUIPMENT – NOT USED

2.6 COMPONENTS

A. Static Battens:

- 1. Battens to be manufactured from Schedule 40 steel black pipe, nominal 1-1/2" diameter, 1.9" outside diameter. Pipe to be finished black. Steel tube may be employed if of identical size and equal or greater strength. Finish black.

B. Clips, Wire Rope:

- 1. Size forged "U"-bolt wire rope clips (Crosby clips) appropriately for the cable construction, diameter and lay of the cable with which they are employed.

C. Compression Sleeves:

- 1. Size compression sleeves appropriately for the cable construction and diameter of the cable with which they are employed.

D. Eyebolts:

- 1. Size eyebolts for the intended application. Employ dropped forged steel shoulder pattern eyebolts.

E. Shackles:

1. Size loose pin shackles appropriately for the intended application. Execute chain connections with chain shackles; other connections may employ anchor shackles.
2. Size the screw pins where required to ensure that the threads are not included in the bearing surface of the bolt.

F. Thimbles, Wire Rope:

1. Size wire rope thimbles appropriately for the cable construction and diameter of the cable with which they are employed.

G. Thimbles, Manila/Fibrous and Synthetic Rope:

1. Size appropriately for the rope construction and diameter of the rope with which they are employed.

H. Turnbuckles:

1. Size turnbuckles appropriately for the cable construction and diameter of the cable with which they are employed. Provide jaw-jaw with safety bolt clevis pin.

2.7 ACCESSORIES – NOT USED

2.8 MIXES – NOT USED

2.9 FABRICATION – NOT USED

A. Shop Assembly – Not used

B. Fabrication Tolerances – Not used

2.10 FINISHES

A. Shop Priming – Not used

B. Shop Finishing – Not used

C. Winch Motors and Frames: Gray

D. Signage:

1. Provide signage legible in construction and grammar. Sign surfaces and characters shall be textured or otherwise treated to minimize glare and veiling reflectance.
2. Provide an engraved black lamacoid plaque, with white 3/8 inch characters next to the loading diagrams at stage and loading gallery elevations. List on the plaque the standard size of counterweights provided and their respective weights. Engrave a warning on the plaque cautioning against unauthorized and untrained personnel operating the rigging system.

2.11 SOURCE QUALITY CONTROL

A. Tests, Inspection – Not used

B. Verification of Performance – Not used

- C. Work on the systems may be reviewed at the point of manufacture a minimum of one time during fabrication. This review will occur during the final factory checkout prior to shipping, unless the Manufacturer and Architect agree on a more advantageous inspection date.

PART 3 - EXECUTION

3.1 INSTALLERS – NOT USED

3.2 EXAMINATION

- A. Examine drawings and confirm that number, size and location of conduit are adequate for proposed system.
- B. Inspection of components of the Work to ensure no damage has occurred during shipping or storage.
- C. Site Verifications of Conditions:
 - 1. At earliest opportunity, the Contractor shall inspect all the spaces where theatre equipment components are to be installed. The Contractor shall ensure that no obstacles exist which might prevent proper installation, preclude the smooth operation of mechanisms or cause wear and tear to installed systems.
 - 2. Survey all relevant areas and verify dimensions. If requested, make whatever modifications are deemed necessary to the theatre equipment components.
 - 3. Examine work prepared by others to receive work of this Section. Commencement of the work shall be construed as complete acceptance of preparatory work by others. The inspection includes but is not limited to:
 - a. Ensure mounting surfaces are ready to accept the Work.
 - b. Verify mounting conditions are flat, plumb, and level.
- D. Discrepancies:
 - 1. In the event of discrepancies, immediately notify the Architect.
 - 2. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.
 - 3. Commencement of Work shall indicate an acceptance of existing conditions.

3.3 PREPARATION

- A. Protection – Not used
- B. Verify field measurements at the site prior to installation and modify the system accordingly.
 - 1. Deliver equipment to the site only after the building has been closed in. Coordinate storage at the site and ensure the materials and components are undamaged.
 - 2. Protect the surrounding environment from damage by the Work.
- C. Surface Preparation:
 - 1. Clean surfaces as necessary prior to commencing the Work.

3.4 ERECTION, INSTALLATION AND APPLICATION CONSTRUCTION

- A. Special Techniques – Not used
- B. Interface with Other Work – Not used
- C. Sequences of Operation – Not used
- D. Site Tolerances – Not used
- E. General:
 - 1. Trim sets to provide horizontal track and batten set-up.
 - 2. Mouse turnbuckles and shackles with a malleable wire after adjustment.
 - 3. Align the center of each batten with the centerline of the proscenium opening.
 - 4. Rig other loads as specified in the Contract Documents.
- F. Theatrical Drapery
 - 1. Install Theatrical Drapery on tracks and fixed pipes as indicated in the Drawings.
- G. Motorized Rigging Installation:
 - 1. Install all local controls including motor control/starter cabinets, limits, and positioning devices. Coordinate with Division 26 for connection to fixed disconnects and other power sources.
- H. Additional Installation
 - 1. Signage:
 - a. Install signage as described in the Contract Documents.

3.5 REPAIR/RESTORATION – NOT USED

3.6 RE-INSTALLATION – NOT USED

3.7 FIELD QUALITY CONTROL

- A. Inspection:
 - 1. During the installation of equipment, the Contractor shall arrange for safe access as necessary for inspection of equipment by the Architect.
 - 2. Repair or replace any equipment that fails to meet with the Specifications with suitable equipment prior to testing and final inspection.
 - 3. At the time of these inspections, remove all temporary bracing, scaffolding, etc. to permit full operation of and access to all equipment.
- B. Site Testing:
 - 1. Provide fourteen (14) days' notice of all tests so that the Architect may witness such tests.
 - 2. Clearly record the date, time, details and results of all the following tests and demonstrations and any subsequent re-tests. This will form the start of a system logbook to be handed over to the user after acceptance together with operation and maintenance manuals.

-
3. General:
 - a. Inspect the completely assembled system including all mechanisms, fittings, control panels, etc., and make good all deficiencies.
 - b. Demonstrate compliance with tolerances specified in the Contract Documents.
 4. Load Test:
 - a. Submit proposal for test weight for review by Architect.
 - b. Provide weights for the duration of the tests and any subsequent re-testing.
 - c. Provide verification that the correct test loads are provided.
 - d. Load each motorized lineset with distributed weights equivalent to 110 percent specified static load.
 - e. Demonstrate motion with full specified dynamic payload.
 - f. Verify speed, noise and stability compliance with the Contract Documents.
 - g. With each motorized lineset fully loaded for dynamic testing, perform motor current checks.
 - h. Comprehensively verify the accuracy of positioning of each motorized lineset approached from both directions to each preset position.
 5. Provide demonstration and testing as required to obtain certification that may be required by the Authority Having Jurisdiction. This Contractor is solely responsible for obtaining such certification and all costs arising there from. Certification is a condition of final payment.
 6. Final Inspection:
 - a. Final review will be made by the Architect following written notice from the Contractor that the installation is complete.
 - b. At the time of inspection, furnish sufficient workers to operate all equipment and to perform such adjustments and tests as may be required by the Architect. Repair or replace any equipment that fails to meet with the specifications with suitable equipment. The inspection shall be rescheduled under the same conditions as previously specified.
 - c. At the time of these inspections, no other work shall be performed in the auditorium and stage areas. Remove all temporary bracing, scaffolding, etc. to permit full operation of and access to all equipment.

C. Manufacturers' Field Services – Not used

3.8 ADJUSTING - NOT USED

3.9 CLEANING

- A. Provide clean up, including removal of packing materials, construction debris, etc., resulting from the execution of the Work.
- B. Protect surfaces or equipment provided by other sections. Clean and repair any damage to portions of the Work during the execution of the Work.
- C. Protect surfaces or equipment provided by this section. Coordinate to ensure that the Work is not damaged during subsequent installations by other trades.

3.10 DEMONSTRATION

- A. Demonstrate system operation and instruct the Owner in the proper use, care, and maintenance of all items.
- B. Training
 - 1. Provide a total of twenty (20) hours of training to the Owner on use and maintenance of this equipment after the systems have been commissioned and accepted as satisfactory. These sessions are to consist of no fewer than five (5) four-hour periods.

3.11 PROTECTION – NOT USED

3.12 SCHEDULES – NOT USED

End of Section
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Section 11 61 43
THEATRICAL DRAPERIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes the manufacture of Theatrical Draperies and accessories required for visual masking, acoustics, and decorative effects.
- B. Section Includes:
1. Work in the following space:
 - a. Auditorium
 2. Systems:
 - a. House Curtain
 - b. Masking Legs and Borders
 - c. Traveler
 - d. Scrim
 - e. Cyclorama
 - f. Storage Hampers
 - g. Storage Bags
 - h. Supervision of installation of the Theatrical Drapery by the 11 61 33 Theatrical Rigging contractor
 3. Provision of all labor, materials, components, modifications, assemblies, equipment, and services necessary to provide the draperies as shown on the Drawings or as specified herein, including, but not limited to:
 - a. Verification of site dimensions and conditions
 - b. Submittals as required by the Contract Documents
 - c. Design and Shop Drawings
 - d. Manufacture of draperies and systems as required by the Contract Documents
 - e. Scheduling, sequencing, and coordination with other trades
 4. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.
- C. Products Supplied But Not Installed Under This Section:
1. Installation of all drapery included in this section is specified in Section 11 61 33 Theatrical Rigging.
- D. Products Installed But Not Supplied Under This Section – Not used

E. Related Sections:

1. Division 01: General Requirements
2. Division 11: Equipment:
 - a. Section 11 61 33: Theatrical Rigging

F. Allowances – Not used

G. Unit Prices – Not used

H. Measurement Procedures – Not used

I. Payment Procedures – Not used

J. Alternates – Not used

1.2 REFERENCES

A. National Fire Protection Association (NFPA) Standards:

1. NFPA701 Standard Methods for Fire Tests for Flame-Resistant Textiles and Films

1.3 DEFINITIONS

A. OC: on center

B. ID: inner diameter

1.4 SYSTEM DESCRIPTION

A. The following establishes minimum safety requirements for the system. Where federal, state and local legislation address these topics, the more stringent requirements shall take precedence. Factors listed below in no way relieve the Contractor from the sole responsibility of providing safe systems.

B. Design Requirements:

1. Construct drapes to present decorative and functional finishes. Construction shall reflect the standard of care, dimensional, acoustic, and aesthetic requirements specified herein and elsewhere in the Contract Documents.
2. Provide drapes in colors that are exact matches to the reference colors specified. Acceptance of products is dependent upon the ability of the manufacturer to match colors to the satisfaction of the Architect.
3. Provide masking drapes in fabric that exhibits no appreciable color shift to red when lit with primary blue light.

C. Performance Requirements:

1. Construct draperies to withstand and compensate for reasonable variations in environmental conditions, normal wear and tear, and regular usage.
2. Construct draperies so that vertical edges and pleats hang plumb without pulling or turning under.

3. Flameproofing: Flame-retard materials throughout to conform to NFPA 701 as well as other applicable local, state, province and federal codes.
 - a. Flame-retard in accordance with the recommendations of manufacturers: DuPont, Monsanto, or accepted equal.
 - b. Materials submitted showing evidence of sprayed flame-retardant are unacceptable.
 - c. Employ non-hygroscopic, non-crystalline agents in the flame-retarding process.
 - d. Flame-retard fabrics by immersion for compliance with applicable codes.
 - e. Perform flame-retarding in a manner to minimize stiffness in the fabric.
 - f. Flame-retard fabrics prior to drapery fabrication.
 - g. Flame-retardant shall be valid for not less than five (5) years following the date of installation.
 - h. Provide certification of flame-retarding suitable for framing

1.5 SUBMITTALS

- A. All submittals shall be in accordance with Division 1. All submittals shall be submitted in a timely manner, allowing sufficient time for adequate review and possible re-submittal without jeopardizing the project schedule.
- B. Product Data:
 1. Storage hampers
- C. Shop Drawings: For fabrication of all draperies.
 1. Shop Drawings shall be submitted within ninety (90) days of award of contract.
 2. Drawings will show all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation.
 3. Fabrication shall not commence until the Theatre Consultant has approved Shop Drawings.
 4. All sheets in the Submittal shall be of the same size.
 5. Submittal shall include a title sheet listing all sheets in the Submittal.
- D. Samples:
 1. Manufacturer's color charts showing the full range of colors available.
 2. Provide samples of each type of fabric in the selected colors, including samples matching Architect's sample for custom colors.
 3. Provide samples of masking fabric from each dye lot to be utilized for evaluation of color shifting properties.
- E. Quality Assurance/Control – Not used
 1. Submittals – Not used
 2. Design Data – Not used
 3. Test Reports, Certificates – Not used
 4. Manufacturers' Instructions – Not used

5. Manufacturers' Field Reports – Not used
6. Qualification Statements – Not used

F. Closeout Submittals

1. Certificates of flame-resistance for all fabrics.
2. Provide three (3) hard copies of all Shop Drawings, including any updates or revisions to the original submission.
3. Bind all Operation and Maintenance (O&M) documentation separate from general building sections so they can be turned over to the users after approval.
4. Provide draft copy of completed manuals for review to the Theatre Consultant before the start of commissioning.
5. Provide the following electronic files:
 - a. Shop Drawings in their native electronic files (AutoCAD or similar)
 - b. All Submittal files, including Shop Drawings, in a Portable Document File (PDF) format

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: A firm with a minimum of fifteen (15) years of experience in the type of Work required by this section.

B. Regulatory Requirements:

1. Flame-Resistance: Comply with NFPA 701 and applicable local, state, and federal codes.
 - a. Natural fiber fabrics shall be chemically treated at the mill for flame resistance using a non-hydroscopic, non-crystalline, permanent agent in an immersion process. Follow manufacturer's recommendations. Materials submitted showing evidence of sprayed flame-retardant are unacceptable. Flame-resistance shall be effective for not less than two (2) years following the date of installation.
2. Inherently flame-resistant (IFR) masking material drapery shall be fabricated from synthetic polyester fabrics complying with NFPA 701.

C. Certifications – Not used

D. Field Samples – Not used

E. Mock-ups – Not used

F. Pre-installation Meetings – Not used

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading – Not used

B. Acceptance at Site – Not used

C. Storage and Protection:

1. Store draperies in dry, humidity-controlled spaces only.
2. Protect draperies individually in plastic bags or cardboard cartons. Protect additional items with suitable plastic wrap to protect from damage.

D. Waste Management and Disposal – Not used

1.8 PROJECT CONDITIONS

A. Project Environmental Requirements – Not used

B. Existing Conditions – Not used

C. Field Measurements: Verify dimensions of draperies by field measurements before fabrication and indicate measurements on Shop Drawings.

1.9 SEQUENCING – NOT USED

1.10 SCHEDULING – NOT USED

1.11 WARRANTY

A. Special Warranty: Warrant systems and equipment to be free of defective components and faulty workmanship for a period of two (2) years from the date of acceptance. Replace items showing evidence of defective materials or workmanship within thirty (30) days after notification. Make replacements without cost to the Owner.

B. Designate warranties on manufactured equipment to the Owner to commence on the date of acceptance.

1.12 COMMISSIONING – NOT USED

1.13 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials described below that match products provided, are packaged with protective covering for storage, and are identified with typed labels clearly describing contents.
 - a. Provide 10 percent of the total quantity of tie lines and clips.
 - b. Provide three (3) running yards of each fabric type for use as patching.
 - c. Provide container suitable for the long-term storage and protection by the owner of all extra materials provided under this section. Clearly label container "Theatrical Drapery Repair Kit."

B. Maintenance Service – Not used

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the requirements, provide products by one of the following manufacturers:

1. I. Weiss & Son, Fairview, NJ - 201-402-6500
2. Rose Brand, Secaucus, NJ – 800-223-1624
3. Stage Decoration & Supplies, Inc., Greensboro, NC – 888-220-3174
4. Gerriets, Ewing, NJ – 609-771-8111
5. Texas Scenic Company, San Antonio, TX – 800-292-7490
6. Syracuse Scenery and Stage Lighting Co., Inc., Liverpool, NY – 800-453-7775

2.2 EXISTING PRODUCTS – NOT USED

2.3 MATERIALS

- A. Fabrics: Employ fabrics of one (1) color from the same dye lot with no split widths or mismatched pieces.
- B. House Curtain – 26 ounce IFR Velour:
1. Material: 100 percent “Avora”, 25-26 ounce per linear yard based on a 54 inch width.
 2. Color: Manufacturer’s standard as selected by Architect.
 3. Accepted Fabric Manufacturers:
 - a. Basis of design:
 - i. “Prestige” KM Fabrics, Inc., Greenville, SC – 800-845-1896
 - ii. “Dante 8203” J.B. Martin, St-Jean-sur-Richelieu, Quebec, Canada – 514-916-9003
 - iii. “Lido Plus” Gerriets International, Allentown, NJ – 609-771-8111
- C. House Curtain Lining:
1. Material: 100 percent synthetic muslin IFR
 2. Thread Count: 96 by 60
 3. Color: Manufacturer’s standard as selected by Architect
 4. Accepted Fabric Manufacturers:
 - a. Basis of design:
 - i. “PD Cloth” Dazian Fabrics, New York, NY – 877-232-9426
 - ii. Poly Muslin - IFR, Rose Brand, New York, NY - 800-223-1624
 - iii. Avora lining, Rose Brand, New York, NY
- D. Masking Drapery: Legs, Borders, and Traveler – 22 ounce IFR Velour:
1. Material: 100 percent “Avora”, 22 ounce per linear yard based on a 64 inch width
 - a. Color: Manufacturer’s standard as selected by Architect.
 - b. Accepted Fabric Manufacturers:
 - i. Basis of design:
 - a. “Encore”, Milliken & Company, Spartanburg, SC – 864-503-2020

b. Or approved equal

E. Sharkstooth Scrim:

1. Material: 100 percent Trevira, inherently flame resistant (IFR), 4 ounces per linear yard based on a 35'-0" width.
2. Color: As per Drawings and Schedule
3. Accepted Fabric Manufacturers:
 - a. Basis of design:
 - i. Rose Brand, New York, NY - 800-223-1624

F. Cyclorama - synthetic IFR muslin:

1. Material: 100 percent polyester, inherently flame resistant, 14 ounces per linear yard.
2. Color: As per Drawings and Schedule
3. Accepted Fabric Manufacturers:
 - a. Basis of Design:
 - i. Poly Cyc, Rose Brand, New York, NY - 800-223-1624
 - ii. Poly Muslin, Rose Brand, New York, NY - 800-223-1624

2.4 MANUFACTURED UNITS – NOT USED

2.5 EQUIPMENT – NOT USED

2.6 COMPONENTS

- A. Webbing: 3 inch wide nylon or polyester webbing.
- B. Grommets: Number 2 black metal washer grommets unless otherwise noted.
- C. Chain Weights: Zinc plated #8 jack chain sewn into muslin sleeve.
- D. Rings clips, eyebolts, and spring clips: black factory finish.

2.7 ACCESSORIES

- A. Tie Lines: Solid braided black "venetian blind" or mason cord NO 4-1/2 (9/64-inch diameter)
- B. Snap Hooks: Nickel-plated drapery-to-carrier snap fastener
- C. Storage Bags: Heavy weight canvas bags with dust flap, double thick bottoms, and draw-string closure
- D. Hampers:
 1. Provide with spring steel frame with welded joints, hardwood bottom, and wear points reinforced with leather.
 2. Provide with four (4) swivel casters with minimum 4-inch diameter rubber wheels.

3. Provide with heavy weight canvas duck body with riveted seams.
4. Provide with hinged plywood top with top mounted caster stop blocks for stacking hampers.
5. Provide with capacity of 24 bushels.

2.8 MIXES – NOT USED

2.9 FABRICATION

A. Shop Assembly – Not used

B. Fabrication Tolerances – Not used

C. General:

1. Fabric shall be inspected for weaving flaws and imperfections prior to fabrication.
2. Unless specified otherwise herein, sew fabrics with nylon filament thread. Employ matching thread throughout.
3. Unless otherwise specified, sew drapes pile up.
4. Construct drapery with the center of the center panel of fabric on the centerline of the drape. Legs shall be sewn with full widths only.
5. Fabricate drapery panels to run the height of the various sections without horizontal seams. Fabric nap or pile must run in the same direction, unless otherwise specified.
6. Locate grommets in the center of the webbing width so no horizontal stitching is cut or severed. Locate grommets on 1'-0" centers.
7. Double grommet the upper corners of each masking section so that either panel may be used stage left or stage right.
8. Fabricate so that the bottom edge of the face fabric and lining is within 1/4 inch parallel with the top edge of the drapery, for true hanging across full width.
9. Provide a fire test strip 24 inches long from the face material sewn into one turnback or side hem.

D. House Curtain:

1. Provide each panel to the dimensions and fullness indicated on the Schedule.
2. Fabricate the House Curtain from velour in two (2) lined panels to provide for bi-part action.
3. Box pleat at the top in the fullness listed, exclusive of turnback facing. Conceal vertical drapery seams in the box pleats. Sew pleats on the face side of the drapery and reinforce across the top with webbing.
4. Fabricate from material with weights as called out in this Section, with fabric nap down.
5. Finish bottom of the face fabric with an 8-inch stitched hem so that no machine stitching is visible on the face. The bottom of drape shall be weighted with steel tape weight inserted in the hem and held clear of the bottom of the hem.
6. Finish bottom of drape with a light flap consisting of a double layer of face fabric sewn into bottom hem so that bottom of flap hangs 1.5 inches below bottom of finished drape.

7. Face back both side edges of each panel with 1/2 width of fabric. Use no machine stitching in the turnback area to prevent fabric pulling.
 8. Lining:
 - a. Line drape in the same fullness as the face fabric.
 - b. Sew lining into the face curtain at the top hem.
 - c. Sew shrinkage tucks into lining fabric. Shrinkage tucks shall allow for extending the length of the lining fabric by removing a row of stitching as required due to unequal stretching of fabrics. Provide two (2) 6 inch shrinkage tucks in the lining fabric. Place all shrinkage tucks within 4 feet of the bottom hem.
 - d. Sew lining into the bottom hem of the face curtain.
 - e. Attach sides and bottom of each panel with lengths of hook and loop tape 10 inches long located on 36-inch centers at sides and at vertical seams at bottom.
 - f. Finish bottom hem of the lining 2 inches shorter than the face fabric.
 - g. Provide a canvas pocket on the rear of the drape lining to accommodate the traveler idler block.
 9. Locate double grommets at leading edge to precisely align with traveler master carrier attachments.
 10. Supply the drapery with loose oblong snap clips for attachment to traveler carriers.
 11. Provide paging handle on the back side of the leading edge of each panel and at the offstage edge of each panel.
 - a. Locate the handle 42 inches AFF and secure to the turnback face material with a stitched canvas gusset.
 - b. Locate intermediate handles at several vertical seams.
 - c. Each handle shall be a unique color.
- E. Masking Legs and Borders:
1. Provide each panel finished to the dimensions and fullness indicated on the Schedule.
 2. Box pleat at the top in the fullness listed, exclusive of turnback facing. Conceal vertical drapery seams in the box pleats. Sew pleats on the face side of the drapery and reinforce across the top with webbing.
 3. Fabricate from masking material with weights as called out in this Section.
 4. Reinforce tops with webbing and grommets 12 inches OC and double grommets at both ends.
 5. Finish bottoms of masking legs, tabs and borders with a 6-inch double turned hem including a #8 canvas duck batten pocket. Seal ends of batten pocket with hook and loop tape. In addition, the bottom of drape shall be weighted with #8 chain weight inserted in the hem and held clear of the bottom of the hem.
 6. Finish sides of legs and tabs with a 6-inch turnback. Finish sides of borders with a 2 inch turnback.
 7. Secure to batten with black 36-inch NO 4 black cotton tie lines.

F. Bi-part Traveler:

1. Fabricate the traveler from masking material in two (2) (mid traveler) or four (4) panels (upstage traveler) to provide for bi-part action. Finish each panel to the dimensions and fullness indicated on the Schedule.
2. Box pleat at the top in the fullness listed, exclusive of turnback facing. Conceal vertical drapery seams in the box pleats. Sew pleats on the face side of the drapery and reinforce across the top with webbing.
3. Fabricate from masking material with weights as called out in this Section.
4. Finish the bottom of the face fabric with a 6-inch hem. The bottom of drape shall be weighted with chain weight inserted in the hem and held clear of the bottom of the hem.
5. Face back both side edges of each panel with a 6-inch turnback.
6. Reinforce tops with webbing and grommets 12 inches OC and double grommets at both ends.
7. Supply the drapery with snap clips for attachment to traveler carriers.

G. Scrim

1. Fabricate the scrim from seamless panels of sharktooth scrim finished to the dimensions indicated in the Schedule.
2. Reinforce the top with webbing. Provide zinc plated grommets 12 inches OC and double grommets at both ends.
3. Finish the bottom with a 4-inch hem. Include a cotton duck pocket for a 3/4-inch nominal pipe batten, stitched to the top of the hem so as to position the batten 1 inch above the bottom of the scrim. Size pocket to allow easy insertion and removal of a bottom pipe batten of up to 1-inch nominal pipe.
4. Finish the sides with a 2-inch double turned hem with 3/8-inch stretcher cord inserted within. Reinforce eyelets where stretcher cord exits seam
5. Secure to batten with black 36-inch NO 4 black cotton tie lines.

H. Cyclorama:

1. Fabricate the cyclorama from a single piece of fabric to the dimensions indicated in the Schedule.
2. Reinforce the top with webbing. Provide zinc plated grommets 12 inches OC and double grommets at both ends.
3. Finish the bottom with a 4-inch hem. Include a cotton duck pocket for a 3/4-inch nominal pipe batten, stitched to the top of the hem so as to position the batten 1 inch above the bottom of the scrim. Size pocket to allow easy insertion and removal of a bottom pipe batten of up to 1-inch nominal pipe.
4. Finish the sides with a 2-inch double turned hem with 3/8 inch stretcher cord inserted within. Reinforce eyelets where stretcher cord exits seam
5. Secure to batten with black 36-inch NO 4 black cotton tie lines.

I. Signage:

1. Mark the centerline of the webbing with indelible marker. Use a white tie line on the centerline grommet.

-
2. Sew a white fabric label on the upper right and left corners of the webbing of the drape with the following information in the following formats. The label shall be no smaller than 3 inches by 6 inches and in no cases should the text size be smaller than 1/8 inch high.
 - a. For draperies sewn from inherently flame-resistant (IFR) material:

ITEM NAME:

ITEM NUMBER:

DIMENSIONS: FULLNESS:

DATE OF MANUFACTURE:

MANUFACTURED FROM INHERENTLY FLAME-RESISTANT MATERIALS MEETING

NFPA 701, _____

MANUFACTURED BY:

THEATRE CONSULTANT: THEATRE PROJECTS

- b. List compliance of IFR materials with NFPA 701 and applicable local, state, and federal codes.
3. Label one bottom corner with flame-proofing information for code official.

2.10 FINISHES – NOT USED

- A. Shop Priming
- B. Shop Finishing

2.11 SOURCE QUALITY CONTROL – NOT USED

- A. Tests, Inspection
- B. Verification of Performances

PART 3 – EXECUTION

3.1 INSTALLERS – NOT USED

3.2 EXAMINATION

- A. Site Verification of Conditions:
 1. Examine work prepared by others to receive work of this Section.
 - a. Ensure mounting surfaces are ready to accept the Work.
 - b. Verify mounting conditions are flat, plumb, and level.
 - c. Inspect components of the Work to ensure no damage has occurred during shipping or storage.
 2. Discrepancies:
 - a. In the event of discrepancies, immediately notify the Architect.

- b. Do not proceed with the installation in areas of discrepancy until all such discrepancies have been fully resolved.
- c. Commencement of Work shall indicate an acceptance of existing conditions of preparatory work by others.

3.3 PREPARATION

- A. Protection – Not used
- B. Surface Preparation:
 - 1. Clean surfaces as necessary prior to commencing the Work.
- C. Verify field measurements at the site prior to installation and modify the system accordingly.
 - 1. Deliver equipment to the site only after the building has been closed in. Coordinate storage at the site and ensure the materials and components are undamaged.
 - 2. Protect surrounding environment from damage by the Work.

3.4 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION

- A. Special Techniques – Not used
- B. Interface with Other Work – Not used
- C. Sequences of Operation – Not used
- D. Site Tolerances
 - 1. Supervise installation of drapery as shown on the Drawings or as directed by Theatre Consultant.
 - 2. Supervise installation and adjustment of Theatrical Drapery by the 11 61 33 Theatrical Rigging contractor.
 - 3. Supervise installation and adjustment of Theatrical Drapery by the 11 61 11 Adjustable Acoustic contractor.
 - 4. Hang additional draperies not indicated on the Contract Documents on an available batten per the direction of the Theatre Consultant for review and acceptance.
 - 5. Align the center of each border, cyclorama, and traveler with the centerline of the proscenium opening or performance area.

3.5 REPAIR/RESTORATION – NOT USED

3.6 RE-INSTALLATION – NOT USED

3.7 FIELD QUALITY CONTROL

- A. Site Tests, Inspection:
 - 1. Provide fourteen (14) days' notice of tests so Theatre Consultant may witness such tests.

-
2. General:
 - a. Inspect draperies and make good deficiencies before declaring the system is complete.
 - b. Demonstrate compliance with tolerances specified in the Contract Documents.
 3. Initial Inspections:
 - a. Inspect components of the Work to ensure no damage has occurred during shipping or storage.
 - b. Drapery which fails to meet with the specifications shall be repaired or replaced with suitable drapery prior to Site Tests and Final Inspection.
 - c. Right of review by the Theatre Consultant is reserved during the course of the installation, as is access to materials at the site for eventual incorporation in the Work. Preliminary review will not be construed as eliminating the possible rejection of various components during the final inspection.

B. Manufacturers' Field Services – Not used

C. Reviews:

1. Final review will be made by the Architect following receipt in writing or notification from the Contractor that the installation is completed.

3.8 ADJUSTING – NOT USED

3.9 CLEANING – NOT USED

3.10 DEMONSTRATION

- A. Demonstrate to the Architect that the drapery elements perform per the intent of the Contract Documents prior to acceptance of the drapery.

3.11 PROTECTION

- A. Provide protection for all materials and equipment provided by this section against damage by dirt, paint, damp, and physical abuse until system is accepted and handed over to Owner. This includes providing purpose-made covers that shall be temporarily removed to allow testing and commissioning of the system.
- B. Coordinate to ensure that the Work is not damaged during subsequent installations by other trades.
- C. This Work will only be accepted in "as new" condition.

3.12 SCHEDULES

- A. See Drawings.

End of Section

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SECTION 11 61 91
THEATRICAL LIGHTING INSTRUMENTS AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes Theatrical Lighting Instruments and Accessories used on the stage and in front of house lighting positions for the illumination of the performance areas.
- B. Section Includes:
1. Work in this section includes manufacture, furnishing and installation of theatrical lighting instruments and accessories for the following space:
 - a. Auditorium
 2. Section includes materials, components, modifications, assemblies, equipment and services as specified herein, including but not limited to:
 - a. LED stage lighting instruments
 - i. Ellipsoidal fixtures
 - ii. PAR/Wash fixtures
 - iii. Cyc fixtures
 - b. Automated stage lighting fixtures
 - c. Stage lighting accessories
 - i. Top hats
 - ii. Half hats
 - iii. Donuts
 - iv. Template holders
 - v. Lens tubes
 - vi. Barndoors
 - vii. Cable storage carts
 - viii. Disposable lighting accessories
 - d. Loose electrical distribution
 - i. Jumper cables
 - e. Data cable, fixture assembly, lamping, bench focusing, and removal and disposal of packing materials.
 - f. Installation and focus of fixtures specified herein based on a light plot as shown in the drawings.
 3. Furnish equipment and hardware in addition to the items specified previously that are necessary to provide a fully working system in conformance with the intent of the Contract Documents.

C. Products Supplied But Not Installed Under This Section:

1. Power and data cabling to lighting fixtures
2. Fixture accessories

D. Related Sections:

1. Drawings and general provisions of the Contract apply to this Section, including General and Supplemental Conditions and Division 1 Specification Sections.
2. Division 11: Equipment:
 - a. Section 11 61 33: Theatrical Rigging
3. Division 26: Electrical
 - a. Section 26 61 11: Theatrical Lighting Controls
 - b. Section 26 61 15: Lighting Controls System Integrator (If any)

E. Allowances:

1. Not Used

F. Unit Prices:

1. Provide unit prices for each line item in the Equipment Schedule in Part 3 of this section.

1.2 REFERENCES

A. Reference Standards:

1. Underwriters Laboratories Standards:
 - a. UL498, Electrical Attachment Plugs and Receptacles
 - b. UL1573, Stage and Studio Lighting Units
2. ANSI Standards:
 - a. E1.11 - 2008 (R2018) Entertainment Technology - USITT DMX512-A, Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories
 - b. E1.17-2015 Entertainment Technology - Architecture for Control Networks
 - c. E1.20-2010 Entertainment technology – Remote Device Management over DMX512 Networks
 - d. E1.27-1-2006 (R2016) Entertainment Technology – Standard for Portable Control Cables for use with DMX 512/1990 and E1.11 (DMX 512-A) Products
 - e. E1.31-2018 Entertainment Technology - Lightweight streaming protocol for transport of DMX512 using CAN
3. Institute of Electrical and Electronics Engineers, Inc.:
 - a. Standard: 802.3
 - b. Standard: 802.11 b or g
4. National Electric Code

5. American National Standards Institute
6. International Building Code

1.3 DEFINITIONS

- A. AHJ: Authority Having Jurisdiction
- B. DMX: Digital Multiplexing
- C. NEC: National Electric Code
- D. PC: Neutrik powerCON connector
- E. UL: Underwriters Laboratories, Inc.
- F. USITT: United States Institute for Theatre Technology, Inc.
- G. ESTA: Entertainment Services and Technology Association
- H. FURNISH: Deliver and hand over to others for installation, deliver complete with related accessories
- I. INSTALL: Set in place and connect
- J. PROVIDE: Furnish and install

1.4 SUBMITTALS

- A. Provide submittals in accordance with Division 1. Submit submittals in a timely manner, allowing sufficient time for adequate review and possible resubmittal without jeopardizing the project schedule.
- B. Product Data:
 1. Provide a list of all items to be furnished with manufacturer's catalog numbers for each item.
- C. Shop Drawings:
 1. Drawings and Catalog Cuts shall show all information necessary to explain fully the design features, appearance, function, fabrication, installation and use of system components in all phases of operation.
 2. Fabrication shall not commence until the Theatre Consultant has approved shop drawings.
 3. All sheets in the submittal shall be of the same size.
 4. Submittal shall include a title sheet listing all sheets in the submittal.
 5. Submittal shall include a complete Bill of Materials showing all items being supplied by the manufacturer and or supplier.
 6. Submit with bid the following time estimates:
 - a. Length of time required to furnish all equipment
 - b. Length of time to install and focus the light plot

D. Commissioning:

1. Provide draft copy of completed manuals to the Architect before the start of commissioning for use during commissioning.

E. Closeout Submittals:

1. Organize operating and maintenance manuals into suitable sets of manageable size.
2. Bind data into individual binders for each manual, properly identified on front and spine. For large manuals, provide and index sheet and thumb tabs for separate information categories.
3. Provide heavy-duty three-ring vinyl-covered binders, 1 inch to 2 inch thick as required to contain information, sized for 8-1/2 inch by 11 inch paper with inside pockets or pocket folders for folded sheets.
4. Operations and Maintenance Manuals (O&M) shall include:
 - a. Contact information for Theatre Performance Lighting Instruments and pertinent manufacturers
 - b. Safety and Operational Instructions
 - c. Complete parts and subassembly list
 - d. Wiring diagrams
 - e. Periodic Maintenance Schedule
 - f. A maintenance procedure for finishes
 - g. Records of final testing and log
 - h. Spare parts list and source information
 - i. Warranty documentation
5. Bind all O&M documentation separate from general building sections, so they can be turned over to the users after approval.
6. Provide three (3) hard copies of shop drawings, including updates or revisions to the original submission, to accurately reflect the installed system.
7. Provide three (3) copies of the following electronic files:
 - a. Final shop drawings in their native electronic files (AutoCAD or similar)
 - b. Submittal files, including shop drawings, in a Portable Document File (.pdf) format
8. Submit files on standard PC format USB clearly labeled including project name, Project Architect, Theatre Consultant, Contractor name, and date of Submittal.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Source: To the extent permitted by the product specifications, provide products and accessory components of one manufacturer for each instrument type required for the work of this section.
2. Contractor: A firm with a minimum of five (5) years' experience in the type of work required by this section.

3. Installers: Skilled technicians who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and best industry practices for the proper installation of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading:

1. Deliver stage lighting instruments, cable and accessories securely wrapped in factory fabricated wooden or fiberboard type containers.
2. Handle equipment being furnished carefully to prevent breakage, denting and scoring finish.
3. Do not install or provide damaged equipment; replace and return damaged units to equipment manufacturer.

B. Acceptance at Site:

1. Contractor shall accept and inventory all equipment upon delivery and provide copies to the Architect and Theatre Consultant.

C. Storage and Protection:

1. Store stage lighting equipment in clean dry spaces. Store in original cartons or on battens as directed by the Owner and protect from dirt, physical damage, weather, and construction traffic.
2. All equipment shall be stored in a secure, environmentally controlled location. No equipment shall be installed in its location until that location is substantially completed, free from construction dust, and "broom clean".
3. Installed lighting shall be protected from construction dust and debris.

D. Waste Management and Disposal:

1. All packing material shall be disposed of by the Contractor.

1.7 SEQUENCING

- A. All non-installed Performance Lighting Fixtures and Accessories shall be turned over to the Owner at the time of Theatrical Dimming System acceptance, or at a time previous which is mutually acceptable.

1.8 SCHEDULING – NOT USED

1.9 WARRANTY

A. Special Warranty:

1. Warrant fixtures and equipment to be free of defective components or faulty workmanship for a period of one (1) year from the date of acceptance.
2. Replace items showing evidence of defective materials or workmanship (including installation workmanship) within thirty (30) days after notification. Make replacements without cost to the Owner.
3. Designate warranties on manufactured equipment to the Owner on the date of acceptance.

4. Fixtures shall be warrantied for three (3) years.
5. Lumen maintenance at 50,000 hours shall be L70 B50.
6. Provide cost with bid for additional warranty per year following the three (3) year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The following are recognized system manufacturers for lighting instruments and accessories:

1. AC Lighting: Toronto, Ontario – (416) 255-9494
2. Altman Stage Lighting Company: Yonkers, NY – (914) 476-7987
3. ARRI Inc: Blauvelt, NY – (845) 353-1400
4. Chauvet Lighting: Sunrise, FL – (800) 762-1084
5. Electronic Theater Controls: Middleton, WI – (608) 831-4116
6. Martin: Northridge, CA – (800) 222-0193
7. Signify Lighting: Dallas, TX – (214) 647-7919
8. Robert Juliat: ACT Lighting, Hackensack, NJ – (201) 996-0884

B. The following are recognized manufacturers for lighting accessories:

1. City Theatrical, Inc.: Carlstadt, NJ – (800) 230-9497
2. The Light Source: Charlotte, NC – (704) 504-8399
3. TMB Associates: San Fernando, CA – (818) 899-8818
4. Doug Fleenor Designs: Arroyo Grande, CA – (805) 481- 9599
5. Pathway Connectivity: Calgary, Alberta, Canada – (403) 243-8110
6. Lex Products: Shelton, CT – (800) 643-4460

C. The following are recognized manufacturers for automated fixtures:

1. Electronic Theater Controls: Middleton, WI – (608) 831-4116
2. High End Systems: Austin TX – (512) 836-2242
3. Martin Professional, Inc.: Las Vegas, NV – (702) 597-3030
4. Robe Lighting Inc: Davie, FL – (954) 680-1901
5. Vari*Lite, Inc.: Dallas, TX – (214) 647-7880

D. Lamps:

1. General Electric
2. Osram Sylvania
3. Phillips
4. Ushio

E. Accessories Equipment:

1. SSRC: Duncan, SC – (864) 848-9770
2. TMB Associates: San Fernando, CA – (818) 899-8818
3. Union Connector: Jacksonville, FL – (631) 753-9550
4. BMI Supply: Queensbury, NY – (518) 793-6706
5. Lex Products: Shelton, CT – (800) 643-4460

2.2 SPECIALTY SUBCONTRACTORS

A. The systems described herein shall be provided by a single contractor. The following subcontractors are pre-approved bidders for work contained in this specification:

1. Barbizon Lighting, Woburn, MA – (781) 935-3920
2. Candela Controls, Winter Garden, FL – (407) 654-2420
3. High Output, Canton, MA – (781) 364-1812
4. Main Stage, Pensacola, FL – (800) 851-3618
5. Vincent Lighting Systems, Solon, OH – (216) 475-7600
6. Starlite, Moorestown, NJ – (800) 738-7400
7. Limelight Productions, Lee MA, - (800) 243-4950

B. Other Contractors wishing to bid must submit qualifications to the Architect, Theatre Consultant, and Client for approval prior to bid.

1. Requirements:
 - a. Specialty Subcontractor and the individuals responsible for installation in the field shall have been continuously engaged in the sales and integration of theatrical lighting fixtures equipment similar to that specified herein for a minimum of ten (10) years and shall have supplied at least eight (8) installations of this type and scope.
 - b. Specialty Subcontractors shall have at time of bid and continuously maintain throughout the project and warranty period a Specialty Contractor's license appropriate for work in this Section.

C. Substitutions:

1. Substitutions, changes, or deletions from the plans and Specifications will not be allowed without the prior written approval of the Architect.
 - a. Substitution proposals from manufacturers not listed herein shall be accompanied by sufficient catalogue data, specifications, technical information, shop drawings, and samples to prove equivalence or superiority of the proposed substitution.

2.3 MANUFACTURED UNITS

A. Performance Requirements:

1. Provide electrical equipment listed and labeled for use as indicated by UL or other independent test agency acceptable to the Code Authority or jurisdiction.

2. Provide lamps and lighting instruments to operate from 115 volt 60Hz AC, unless otherwise stated.
 3. Lighting Instruments:
 - a. Provide each lighting instrument with hardware for attachment to Unistrut, black safety cable, power cable fitted with the specified grounded connector and one frame.
 - b. Provide lighting instruments with operating knobs and handles safe to touch for precise operation at all times.
 - c. Provide space for two (2) filters in removable frames in each lighting instrument.
 - d. Provide a slot on ellipsoidal spotlights for insertion of an iris or template holder.
 - e. Provide focus adjustment of ellipsoidal spotlights from a sharp edge beam to a soft edge beam without stray light rays or extraneous internal reflections from the lens tube.
 - f. Connectors:
 - i. Provide each permanently cabled lighting instrument with a standard length of not less than three (3) feet, three (3) conductor cable and grounded stage connector as specified.
 - ii. Provide each demountable cabled lighting instrument with a 5'-0" length of cable and grounded specified connector.
 - iii. Where the fixture does not come with the specified connector, an adapter shall be provided.
 - g. Securely ground metalwork of lighting instruments.
 - h. Ventilate lighting instruments such that no reduction in rated lamp life or deterioration of the component parts of the lighting instruments may be attributed to overheating.
- B. General:
1. Supply all cyclorama lights with the following components:
 - a. Floor trunions: Standard accessory product by manufacturer or approved equal.
 - b. Hanging irons: Standard accessory product by manufacturer or approved equal.
 - c. Clamp: Suitable for attachment to Unistrut.
 - d. Safety cable: Standard accessory product by manufacturer or approved equal black in color.
 2. Supply all LED fixtures with:
 - a. High resolution lens tube in specified beam degrees (when available)
 - b. Incandescent emulation profile
 - c. 16-bit flicker-free dimming from 100% to 0%
 - d. Video mode for flicker-free operation on camera
 - e. RDM for remote addressing and profile selection
 - f. Clamp: hardware suitable for attachment to Unistrut.
 - g. Power-in, Power-thru, DMX input and output receptacles

-
- h. Safety Cable: Standard accessory product by spotlight manufacturer or approved equal black in color.
 - i. One (1) specified connector to Edison AC input cable.
3. Supply all automated lighting instruments with the following components:
- a. Two (2) half coupler pipe clamps with black finish for 1.9 inch O.D. pipe and any additional mounting hardware required to hang each fixture, unless noted otherwise.
 - i. Acceptable Product: Mega Claw: Natural, Part #55.6841.0001
 - b. Two (2) steel channel strut mounting bolts, or other hardware required to mount fixture to steel channel strut.
 - c. Two (2) rated safety cables custom manufactured for this application. The safety cable shall be 12 inches long 1/8 inch cable with loops in either end. A rated quick link shall be provided for affixing the safety cable.
 - d. Custom gobo wheel with the following templates:
 - i. Slot 1 Stock per manufacturer
 - ii. Slot 2 Stock per manufacturer
 - iii. Slot 3 Stock per manufacturer
 - iv. Slot 4 Stock per manufacturer
 - v. Slot 5 Stock per manufacturer
 - vi. Slot 6 Stock per manufacturer
 - e. One (1) powerCON 20APowerCON specified connector to Edison AC input cable
 - f. One (1) 5 pin XLR DMX cable, male/female ends 5'-0" long
- C. LED Ellipsoidal Lighting Fixtures Multi-Color:
- 1. Fixed Angle 19 Degree:
 - a. Acceptable Products:
 - i. Electronic Theatre Controls ColorSource Spot CSSPOTS
 - a. Soft Focus Diffuser
 - b. Smooth Wash Diffuser
 - ii. Altman Phoenix 250w RGBA
 - a. 19 degree lens
 - iii. Chauvet Ovation E-910 FC IP
 - a. 19 degree lens
 - b. Color blending filters DF60X1D, DF20D
 - b. Fixture finish: white
 - 2. Fixed Angle 26 Degree:
 - a. Acceptable Products:
 - i. Electronic Theatre Controls ColorSource Spot CSSPOTS

- a. 426EDLT lens tube
 - b. Soft Focus Diffuser
 - c. Smooth Wash Diffuser
 - ii. Altman Phoenix 250w RGBA
 - a. 26 degree lens
 - iii. Chauvet Ovation E-910 FC IP
 - a. 26 degree lens
 - b. Color blending filters DF60X1D, DF20D
 - b. Fixture finish: white (front of house); black (on stage)
- D. LED PAR/Wash Lighting Fixtures Multi-Color:
- 1. Provide manufacturer's supplied full complement of lenses
 - 2. Acceptable Products:
 - a. Altman Spectra PAR SS-PAR-100-RGBW
 - b. Martin RUSH PAR 2 RGBW Zoom
 - c. ETC ColorSource PAR
 - d. Chauvet COLORado 1-Quad Tour RGB Par
- E. LED Cyc Light Fixtures Multi-Color:
- 1. Acceptable Product:
 - a. Chroma Q Color Force CHCF72NFRGBA
 - b. Electronic Theatre Controls Selador Vivid R (11", 21", 42", 63")
 - c. Electronic Theatre Controls ColorSource CSCYC
- F. Automated Light Fixture:
- 1. General:
 - a. Provide with 12,000 ANSI Lumen LED light engine
 - b. 120 VAC/60HZ operation
 - c. 540° pan and 270 degree tilt ranges of movement
 - d. Cross-fading CYM color mixing system
 - e. Full mechanical dimming system with strobe capability
 - f. Six position gobo wheel with five (5) rotatable gobos
 - g. On-board DMX 512 control interface with fixture addressing via LED Display
 - h. Accessories:
 - i. Provide mounting plates and hardware, pipe clamps, and rated safety cables.
 - i. Fixture and control and power cable finish: white

2. Profile Fixture:
 - a. 12,000 lumens
 - b. Beam angles: 6-48 degrees motorized zoom
 - c. Motorized zoom
 - d. Motorized Iris
 - e. User addressable fan
 - f. Basis of design:
 - i. Elation Artiste Davinci

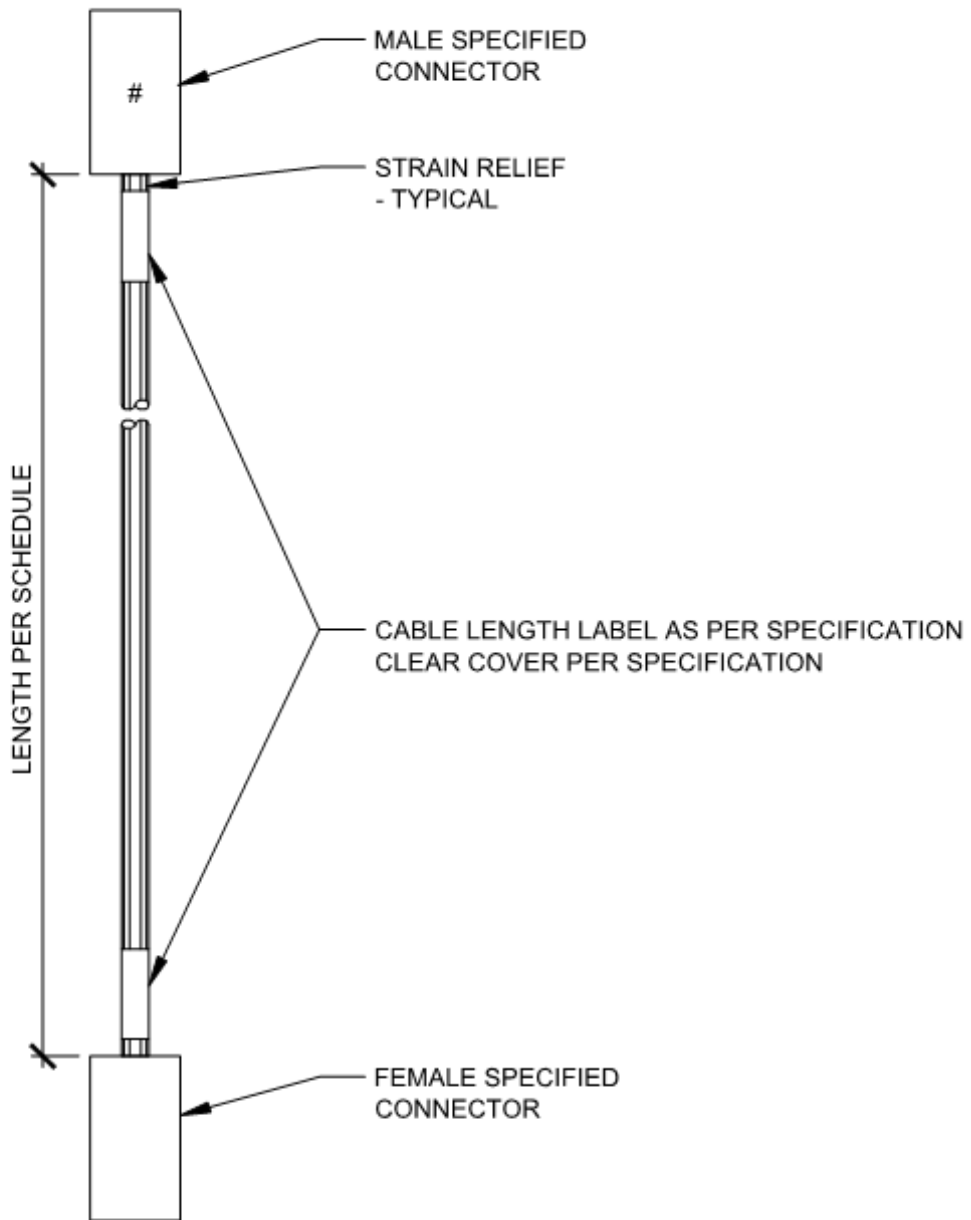
G. Accessories:

1. Performance Lighting Fixture Accessories
 - a. Drop-in iris and template holders:
 - i. Standard accessory product by spotlight manufacturer
 - b. C-clamp
 - i. Standard accessory product by manufacturer
2. Fixture and Cable Storage Bins:
 - a. Provide 27-gallon heavy duty storage bins as required to store cable and accessories not in use in the plot.

H. Cables:

1. Connectors:
 - a. Provide all fixtures and single circuit jumper cables with the following connectors as the "specified connector" in male and female unless otherwise noted:
 - i. PowerCON (PC)
 - a. 20amp 120v powerCON 20A
 - i. Neutrik NAC3FCA
 - ii. Neutrik NAC3FCB
 - b. 15amp 120v NEMA L5-15
 - i. LEX Products #4720-CB male or equal
 - ii. LEX Products #4729-CB female or equal
 - c. 20amp 120v NEMA L5-20
 - i. LEX Products #2311-CB male or equal
 - ii. LEX Products #2313-CB female or equal
 - d. 15amp 125v NEMA 5-15
 - i. Leviton 515PR male or equal
 - ii. Leviton 515CR female or equal
 - e. Ethernet

- i. Neutrik #NE8 Series Black Shell
 - f. DMX
 - i. Neutrik #NC5MXX-B 5-pole male or equal
 - ii. Neutrik #NC5FXX-B 5-pole female or equal
- I. Jumper Cables:
 - 1. General:
 - a. All cables shall be labeled for length at each end and using the following color chart:
 - i. 5' – red
 - ii. 10' – yellow
 - iii. 25' – green
 - b. Provide two clear loose heat shrink sleeves on each cable, for use by the Owner.
 - c. All cables shall be made with strict observance of polarity.
 - 2. Stage jumper cables shall meet the following requirements:
 - a. 20A jumpers shall be made of black type "SO" (extra hard usage), three (3) conductor, #12 cable.
 - i. 20A connectors shall be as noted in the schedule.
 - ii. "Moving Light" jumper cables shall be L6-20 connectors as noted in the schedule.
 - 3. Extension cords shall meet the following requirements:
 - a. All extension cords shall be made of black type "SJO" (junior hard service), three (3) conductor, #12 cable with specified colored tape at each end.
 - b. All connectors shall be three prong, Edison type all black connectors.
- J. DMX Cables:
 - 1. Provide TMB ProPlex PC224P with black 5-pin XLR Neutrik gold contact connectors or equal
 - a. Provide hook and loop cable tie.
- K. Ethernet Cables:
 - 1. Provide TMB ProPlex PCCAT5P with black EtherCon Neutrik connectors or equal.
 - a. Provide hook and loop cable tie.



Pin Cable Detail
Not to Scale

PART 3 - EXECUTION

3.1 INSTALLERS –NOT USED

3.2 EXAMINATION

A. Site Verification of Conditions:

1. Examine areas where performance lighting instruments are to be mounted or otherwise installed and verify that conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this section.
2. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 PREPARATION – NOT USED

A. Protection – Not used

B. Surface Preparation – Not used

3.4 ERECTION, INSTALLATION, APPLICATION, CONSTRUCTION

A. Delivery, Inventory and Testing:

1. Coordinate an area and time for delivery and testing with the contractor and the Owner.
 - a. Area must be clean and free of construction debris.
 - b. Area for this work must be no less than 6 square feet per fixture. Often the best space for this work is the stage floor.
 - c. Area must be available for a minimum of two contiguous days without interruption by other trades and deliveries.
2. Deliver, unpack, and organize all equipment for inspection.
 - a. Equipment will not be inventoried in its packaging material.
3. Fixtures, accessories, and equipment shall be prepared for handover to the Owner.
4. Install accessories where applicable, in accordance with manufacturer's written instructions and with recognized industry practice to ensure that performance lighting equipment complies with applicable requirements of NEC and UL standards.
5. Organize the fixtures and equipment based on type and designated performance space.
6. Organize the inventory process. Provide three (3) copies of the current Bill of Materials.
7. Provide power and control devices for random testing of the fixtures and accessories.
8. Storage:
 - a. Store the fixtures and accessories as directed by the Owner.
 - b. Provide personnel to hang the fixtures on stage battens and to load weights as needed to fly the storage battens.
 - c. Assemble the storage carts, if specified, and hang fixtures, cables and accessories on the carts. Move the carts to storage locations as directed by the Owner.

- d. Move the fixtures and accessories to storage rooms or catwalks as directed by the Owner.
9. Dispose of all packing material.
- B. Interface with Other Work – Not used
- C. Sequences of Operation:
1. Room painting and finishes shall be complete prior to installation.
 - a. Stage lighting fixtures listed herein shall be installed using industry standard practices.
 - b. Stage lighting fixtures shall be plugged to power and control circuits
 - c. Cables shall be dressed with tie line with sufficient slack to allow repositioning of the fixtures.
 - d. Fixtures shall be addressed and patched according to the Owner's direction.
 - e. Test the theatrical lighting installation to verify circuit and control assignments and correct found problems.
 - f. Notify the Architect when the items above are complete.
- D. Focus:
1. Theatrical Fixture Supplier shall provide a board operator and three (3) theatrical electricians for a period not to exceed forty (40) hours to execute the focus.
 - a. Theatrical Lighting Fixture Supplier shall designate one of the theatre electricians as the head electrician for the job. That person shall attend each focus session.
 - b. Theatrical Lighting Fixture Supplier shall identify the board operator for the job. That person shall attend each focus session and each cueing session.
 - c. Board operator shall attend each focus session.
 - d. Board operator and theatrical electricians shall work with the lighting designer and owner's representative to focus fixed luminaires and to prepare moving light fixtures for cueing.
 - e. Forty (40) hour period shall be split into five (5) sessions not exceeding eight (8) hours.
 - i. Sessions may or may not occur on contiguous days.
 - ii. Sessions may or may not fall within standard business hours.
 - f. Board operator shall be well-experienced with the specified console specifically with the ability to address, patch and program moving lights and LEDs.
 - g. Theatrical electricians shall be experienced with trouble-shooting the control system and focusing theatrical fixtures.
 - h. Theatrical Fixture Supplier shall provide access equipment and tools to complete the cue session and trouble shoot problems which may arise during the cueing sessions.
 - i. Hours used to correct problems with the control system or luminaires shall not be deducted from the forty (40) hour total.
 - i. Eight (8) hour sessions will be the maximum hours worked in one (1) session regardless of progress or time devoted to troubleshooting repairs in the control system.

E. Site Tolerances – Not used

3.5 REPAIR/RESTORATION – NOT USED

3.6 FIELD QUALITY CONTROL

A. Site Tests, Inspection:

1. Visual and Mechanical Inspections: Include the following:
 - a. Inspect each spotlight and other loose items of equipment for defects, failure, corrosion, physical damage, and labeling as required.
 - b. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions or routine functional operation.
2. Acceptance Testing:
 - a. Comply with the following conditions required for commissioning:
 - i. All fixtures to be lamped and bench focused.
 - ii. All handover and loose equipment provided under this section to be on site and available for testing.
 - iii. Provide full and uninterrupted access to stage, auditorium, and technical areas required for commissioning tests. Blackouts of lighting will be required.
 - iv. Contractor's project representative to be present during tests as required.
 - v. Provide personnel to operate equipment and perform adjustments as necessary.
 - vi. Provide access equipment as required.
 - vii. Provide walkie-talkie or other communication devices as required.
 - viii. Provide a male Edison adaptor so fixtures can be hot tested from convenience outlets in the theatre.
 - ix. Review manuals, warranties, and turn over documents.

B. Manufacturers' Field Services – Not used

3.7 ADJUSTING – NOT USED

3.8 CLEANING

- A. Clean performance lighting equipment of dirt and debris using methods and materials as recommended by manufacturers upon completion of installation.

3.9 DEMONSTRATION

- A. Provide the services of a qualified manufacturer's representative to provide a minimum of two (2) hours of training in the operation and maintenance of the equipment specified herein. Training sessions shall consist of one (1), six (6) hour session at times separate from the checkout of the system. Arrange training time for the convenience of Owner to take place during the first six (6) months after building acceptance.

3.10 PROTECTION

- A. Protect installed performance lighting equipment and lamps during remainder of construction period.

3.11 SCHEDULE

	Description	Auditorium	Total
LED Ellipsoidal Fixtures Multi-color Light			
1	19 Degree Ellipsoidal (White)	16	
2	26 Degree Ellipsoidal (Black)	15	
3	26 Degree Ellipsoidal (White)	8	
Ellipsoidal Accessories			
4	Top hats for 19 thru 90 degree ellipsoidal	12	
5	Half hat for 19 thru 90 degree ellipsoidal	6	
6	Donut for 19 thru 90 degree ellipsoidal	6	
7	Drop in Iris	4	
8	Pattern holder (A size)	8	
9	Pattern holder (B size)	8	
10	C-clamp (black only)	12	
11	Safety cable (32 inch)	12	
LED PAR/Wash Fixtures Multi-Color			
12	PAR/Wash multi-color (CS NR)	28	
LED Cyclorama/Strip Lights			
13	Cyc Light	5	
Moving Lights			
14	Moving light spot	3	
Accessories			
15	Cable storage bins	As Required	

Power Cable			
16	Jumper cable – 20A – 5' - specified connectors	20	
17	Jumper cable – 20A - 10' - specified connectors	20	
18	Jumper cable – 20A - 25' - specified connectors	4	
Signal Cable			
19	5' DMX extension (5-Pin) XLR	20	
20	10' DMX extension (5-Pin) XLR	20	
21	DMX termination connector	8	
Network			
22	10' Ethernet cable-RJ 45	4	

Note: Schedule is not all inclusive. Refer to specification for additional equipment and accessories.

END OF SECTION

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INSTRUMENTS AND ACCESSORIES.DOCX

Section 11 66 23
GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Wall padding.
- B. Furnish volleyball system (standards, nets and related accessories) to Owner prior to Substantial Completion of Contract.
 - 1. Furnish sleeves for volleyball standards to Section 09 64 66 – Wood Athletic Flooring for installation.

1.3 RELATED REQUIREMENTS

- A. Section 04 22 00 - CONCRETE UNIT MASONRY
- B. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets for wall padding and volleyball system.
 - 2. Manufacturer's installation instructions.
 - 3. Manufacturer's certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
 - 4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 - 5. Shop drawings: Installation details showing mounting conditions, clearances, dimensions.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Jaypro Sports LLC, Waterford, CT.
 2. Porter Athletic Equipment Company, Schiller Park IL.
 3. Performance sports systems, Anderson IN
 4. AALCO Manufacturing Company, Louis MI

2.2 WALL PADDING

- A. Wall padding wainscot: Prefabricated wall-mounted panels, in compliance with Class A flame spread and smoke in accordance with ASTM E84, and the following requirements:
1. Basis of Design: Jaypro Sports product "WallGuard Fire/Impact 2x6", item number JWCF-AI-2472ZZ,
 2. Size: Widths as indicated on Drawings, by 6 feet tall, with cutouts made in field to fit job conditions.
 3. Thickness: Manufacturer's standard 2 inches.
 4. Covering: flame-retardant 14-ounce non-tear vinyl laminated material, mildew and rot resistant, fungicide treated, color to be selected by Architect from manufacturer's full range.
 5. Backing: 7/16 inch thick backing board
 6. Mounting: Z-clip at top and bottom of each panel.
 7. Locations and quantities as shown on drawings.
- B. Corner wall pad: Prefabricated L-shaped foam corner pads in compliance with Class A flame spread and smoke in accordance with ASTM E84, and the following requirements:
1. Size: 6 inches by 6 inches by 6 feet tall, thickness matching adjacent wall panels.
 2. Thickness: Manufacturer's standard 2 inches as applicable to referenced products.
 3. Covering: flame-retardant 14-ounce non-tear vinyl laminated material, mildew and rot resistant, fungicide treated, color to be selected by Architect from manufacturer's full range.
 4. Mounting: Z-clip at top and bottom of each panel.
 5. Locations and quantities as shown on drawings.

2.3 VOLLEYBALL SYSTEM

- A. Volleyball standards: Pair of telescoping aluminum posts consisting of one end post and one reel post with tensioning winch, equal to JayPro Sports, series "3-1/2 inch Featherlite Deluxe Volleyball System", in compliance with all USVBA, NCAA and NFSHSA recommendations and the following requirements:

1. Size: adjustable height, from 6'-1" to 7'-11-5/8"; top of telescoping uprights at same height as top of net.
 2. Material: extruded from high strength, light weight aluminum alloy 6063T6.
 3. Finish: durable clear anodized finish
 4. Mounting: 3-1/2" diameter floor sleeves for each standard.
 5. Tensioning winch: Heavy-duty self-locking ratchet mechanism with self-adjusting disc-brake release.
 - a. Removable handle
 - b. Formed steel cover enclosing ratchet and brake.
 6. Locations and quantities as shown on drawings.
- B. Volleyball net: Equal to JayPro Sports, "Flex Net" in compliance with all USVBA, NCAA and NFSHSA recommendations and the following requirements:
1. Size: 32 feet by 39 inches.
 2. Material: 4 inch square black nylon mesh, with white polyester cableless binding on all sides. Verticals have side pockets to enclosure steel or fiberglass dowels.
 3. Locations and quantities: one net and associated accessories for each pair of volleyball standards as shown on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of project conditions.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.
- D. Inspect prefabricated padding prior to installation.

3.2 INSTALLATION

- A. Install padding in accordance with manufacturer's instructions for each type.
 1. Fasten pads and mounting strips to wall level and plumb; shim as required to keep panels flat.
- B. Install volleyball system in accordance with manufacturer's instructions.
 1. Coordinate installation of floor sleeves with other trades.
 2. Install floor sleeves to accommodate standards plumb and at equal height.

3.3 CLEANING

- A. After completion of the work of this Section, remove equipment, and clean all wall, partition, and floor areas free from materials installed under this Section.
- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.4 PROTECTION

- A. Protect pad covering materials and finished metal surfaces on volleyball system from damage during fabrication, shipping, storage, and erection; advise the Contractor of protective treatment and other precautions required through the remainder of construction.

End of Section

Section 11 66 24
BASKETBALL EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install motorized folding backstops, including backboards and goals.
 - 1. Provide wood pads at wall mounted backstops.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 05 12 00 - STRUCTURAL STEEL FRAMING
- C. Section 04 20 00 – UNIT MASONRY (*Early Masonry Package*).
- D. Section 05 44 00 - COLD-FORMED METAL TRUSSES
- E. Section 05 50 00 - METAL FABRICATIONS
- F. Section 09 91 00 - PAINTING: Field finish painting backstop support assembly.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. General: Coordinate and sequence the work of this Section with the respective trades responsible for installing inserts and anchorages furnished by this Section; make arrangements for delivery, receipt and installation of inserts and anchorages to prevent delay of the Work.
 - a. Through-bolt supports for wall mounted basket ball backstop anchors require installation through masonry back-up construction. Through-bolt must be installed after back-up wall construction is complete and prior to installation of veneer.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Literature: Manufacturer's product data sheets for backstop, including mounting system, motor and electrical characteristics. backboard, goal and netting.
2. Manufacturer's installation instructions.
3. Manufacturer's certificates: Certify that Products provided under this Section meet or exceed UL and specified requirements.
4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
5. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.

1.6 WARRANTY

- A. Provide manufacturer's 10 year warranty year for backboard. Warranty is in addition to and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Porter Athletic Equipment Company, model 90219000 Upfold Basketball Backstop.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering similar products are limited to the following:
 1. Porter Athletic Equipment Company, Schiller Park IL.
 2. Performance sports systems, Anderson IN.
 3. Draper Inc., Spiceland IN.

2.2 BASKETBALL BACKSTOPS

- A. Backstops main court: Motorized, upward folding, adjustable wall-mounted backstops, extended 10' 0-1/8" to 12'-0" from supporting wall, electrically operated, conforming to the latest NCAA and NFSHSA recommendations and be in compliance with the following requirements.
 1. Extension frames shall be fabricated of four 1-7/8" O.D. tubes with a telescoping end section for ease of installation, and precise plumbing and alignment of backboard with official court markings, even when supported on uneven wall conditions. Ends of extension frame assemblies shall be drilled and bolted to fabricated steel hinge plates for attachment to the backside of the backboard and to the wall pads. Hinge plates shall be offset- type to allow backstop to be folded in an almost vertical storage position against the wall.
 2. Backstop shall be horizontally braced with two (2) 3/16" x 1-1/4" steel tension flats attached at both ends with precision die-formed clamps and joined at their intersection with a bolted steel fitting. The lower extension tubes shall be braced mid-span by a 1-7/8" O.D. tube attached with ductile iron "T" casting assemblies. Two chain supports (3/16" proof coil chain) shall extend diagonally from the wall to the upper extension tubes, terminating in clamp-

-
- type fittings. Two chain supports (3/16" proof coil chain) and clamp-type fittings shall be provided for additional vertical bracing between the extension tubes.
3. Manufacture framing to permit backboard vertical field adjustment of 6 inches.
 4. Manufacture framing to permit variable goal height adjustment from 8"-0" to 10"-0" above finished floor.
 5. Fittings: Malleable iron castings and heavy gage steel stampings
 6. Frame finish: Custom shop primed and finished, with one coat primer and two coats of gloss paint in WHITE color to match sample provided by the Architect.
 7. Winch: Electric 1 horsepower worm gear-type winch with heavy formed steel main frame designed to hold backstop at any position during raising and lowering, equal to Draper "Model A503085 Motorized Winch".
 - a. Lifting cable: 1/4 inch diameter 7 by 19 galvanized aircraft cable, having not less than 7,000 pound ultimate breaking strength.
 - b. Control Station: One key operated spring return to center flush mounting wall switch.
 8. Mounting brackets for 3-1/2 inch outer diameter pipe.
 9. Safety locking strap: Provide folding basketball backstops with safety belt and lock system tested to withstand 1,000 pounds (454 kg) free fall load. Safety lock shall be inertia sensitive to automatically lock backstop in position at any time during storage, raising or lowering. Sudden increases in either tension or speed shall activate lock. Safety belt shall be 2 inch (51 mm) wide nylon belt rated at 6,000 pound (2721 kg) breaking strength. Belt shall extend 35 feet (10.7 m) and shall be automatically retracted and stored on a reel equipped with constant force spring. Operation and locking action shall be activated by centrifugal force to lock backstop before unit travels 12 feet (3.7 m) of free fall and shall incorporate and automatic reset without the use of poles, ropes, levers or other devices equal to Draper "Safety Belt Model A0549".

2.3 BACKBOARDS

- A. Backboards and goals for Main Court. Refer to Drawings for quantity/location:
 1. Backboard: Steel frame rectangular glass backboard, Official size 72 by 48 inches, equal to Porter "Pro-Strut" model N°. 00206-000.
 - a. Glass: 1/2 inch thick safety glass, ASTM C 1048 FT, fully tempered, complying with Class 1 clear, quality q3 glazing select, conforming to ANSI Z97.1.
 - b. Border and target markings: Fired vitreous white enamel
 2. Goal: Movable rim goal equal to Porter 00233-000 Power-Flex Goal, conforming to NCAA and NFSHSA specifications for movable rims. High quality enamel finish, furnish with nylon net.
 - a. Provide direct goal attachment to framing to transfer goal stress to mast pipe.
 - b. Backboard Safety padding: 2 inch thick backboard safety padding equal to Porter No. 00227-000, conforming to NCAA specifications, of length to turn up 15 inches on each side of backboard.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install basketball backstops in accordance with manufacturer's instructions. Secure units level and plumb.
- B. Adjust each unit for operating positions, accurately establish lowered position in place.

End of Section

Section 11 66 43
INTERIOR SCOREBOARDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install:
 - 1. Remotely controlled wireless electronic scoreboards and shot clock.
 - 2. All hangers, supports, and fastenings, required for equipment and materials provided necessary for proper and complete operating system.
 - 3. Trim, enclosures and accessories required to make a complete installation.
 - 4. Cage protectors for scoreboards and shot clock.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT: Procedural and administrative requirements for construction recycling.
- B. Division 26 - ELECTRICAL: General provisions and execution for all electrical work and the following:
 - 1. Raceway systems.
 - 2. Power wiring and grounding system.
 - 3. Power wiring.
 - 4. Wiring devices.
 - 5. Panelboards, circuit breakers, disconnects, and relays.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, and installation instructions for each item furnished, including but not limited to:
 - a. Console panel.
 - b. Timer control.
 - c. Scoreboard panel.
 - d. Time panel.
 - e. Lighting elements in panels

2. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 3. Shop drawings:
 - a. Large scale elevations of scoreboard.
 - b. Large scale design details showing attachment clips and brackets; and complete installation details.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's warranties: Include coverage of materials and installation.
 2. Complete set of operating and maintenance instructions.
 3. Wiring diagrams for all components.
- 1.5 QUALIFICATIONS
- A. Manufacturer, with a minimum of 5 years documented experience demonstrating previously successful work of the type specified herein.
- 1.6 DELIVERY, STORAGE AND HANDLING
- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Protect materials from damage due to moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction operations and other causes.
- 1.7 WARRANTY
- A. Provide 5 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Warranty shall include all electronic components, excluding lamps.
- 1.8 EXTRA MATERIALS
- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance which shall include assortment of spare lamps (minimum 24 lamps) and fuses.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Daktronics, Inc., Brookings, SD.
 2. Electro-Mech Scoreboard Co., Wrightsville, GA.
 3. Varsity Scoreboards, Murray, KY.

2.2 SCOREBOARDS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Daktronics "BB-2101".
- B. General: Provide one 8 by 5 feet by 6 inch minimum, with an aspect ratio of 1:2 for width to length dimensions, wireless, 100 percent solid state, single sided scoreboards displaying the following information.
 - 1. Automatic second by second display of time remaining or time elapsed in minutes and seconds for periods up to 99 minutes or less. Metric clock shows tenths of a second and seconds during last minute.
 - 2. Period number 0 through 9.
 - 3. Bonus arrows.
 - 4. Team scores 0 through 199.
 - 5. Team fouls 0 through 99.
 - 6. Uniform number 0 through 99.
 - 7. Volley ball and wrestling options.
 - 8. Next possession indicators.
 - 9. Vibrating horn.
 - 10. Gloss white enameled captions: "HOME" and "VISITOR" are applied 6 inch vinyl lettering.
 - 11. Gloss white enameled caption: "PERIOD" is applied 4 inch vinyl lettering.
 - 12. Operator's wireless master console with running time display, and carrying case.
- C. Display modules LED digit technology 13 inches high for minute and second, 10 inches high for period, 4 inches high for bonus and 3 inches for possession arrows. Clock, colon and period digits and bonus indicators are amber LED, Score digits and possession indicators are red LED. Seven bar segments per digit. Attach scoreboard, to adjacent wall surface as indicated on the Drawings or as otherwise directed by the Architect.
- D. Scoreboard housing: Completely enclosed, all aluminum construction, minimum 0.063 inch thick for face and perimeter and 0.050 inch thick for back. Cabinet shall be designed in manner to permit service access from front of the housing without the use of special tools.
 - 1. Finish: Exposed exterior surfaces shall be immersion etched and finished in in custom colors with gloss white captions and trim.
 - a. Colors as selected by the Architect.
 - 2. School name, Westport, to be applied on board with a minimum of 3 inch vinyl lettering with format as selected by the Architect.
 - 3. Accessories: Provide with all necessary fasteners and brackets for wall mounting.
- E. Control console: Table mounted with a control-display panel in a cast aluminum housing having epoxy thermal-set enamel finish. Panel shall be Interchangeable between football, basketball and other sports and have the following features.

1. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Daktronics "All Sport 5000".
 2. Control is operated with large membrane switches on custom designed cover layout with logical layout.
 3. Time section is controlled by durable positive switches.
 4. The control has easy to read two-line intelligent, 32 character LCD information display with time always display and other information called up instantly.
 5. Control has electric memory for individual play fouls, total team fouls and automatic setting of the bonus indicator.
 6. Control console has removable printed circuit card.
 7. Control "continually refreshes" the signal sent to the scoreboard display so it "remembers" information
 8. Clock has a 100 minute capacity in either remaining or lapsed mode.
 9. Provide the following accessories:
 - a. Remote hand-held control switches for game time and shot clock control.
 - b. External battery control including 12V AC adapter, charger and carrying case.
 - c. 2.4 GHz spread spectrum radio controller utilizing hopping frequency technology with 125 mW transmitter power.
- F. Horn: Federal No. 31 constant duty scoreboard horn with a decibel level of 101.

2.3 SHOT CLOCK

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Daktronics "BB-2114".
- B. General: Provide two, wireless, 100 percent solid state single sided LED shot clocks including the following features:
 1. One operator's hand held reset switch.
 2. Two semi-gloss black display modules with vibrating horn and 11 foot power cord.
 3. Manufacturer's standard portable signal kit.
 4. Visual horn indicator.
- C. Display modules: Lamp matrix numbers 13 inches high, red color, seven bar segments per digit with diffusant lenses over LED display for up to 140 degree viewing angle. Attach each display module, to adjacent wall surface as indicated on the Drawings or as otherwise directed by the Architect.
- D. Scoreboard housing: Completely enclosed, all aluminum construction, minimum 0.063 inch thick except back (0.050 inch thick). Cabinet shall be designed in manner to permit service access to plug-in components from front of the housing without the use of special tools.
 1. Finish: Exposed exterior surfaces shall be immersion etched and finished in dark non-reflecting enamel matching scoreboard color.

- E. Control: Hand held reset switch.
- F. Horn: Vibrator type horn

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION - GENERAL

- A. Perform wiring work as specified in Division 26 - ELECTRICAL.
- B. Install termination assemblies in designated system cabinets.
- C. Provide scoreboards as indicated on the reviewed and accepted shop drawings. Install equipment in accordance with manufacturer's instructions, and all applicable regulatory requirements.
 - 1. Locate scoreboards and timers as indicated on the Drawings.

3.3 WIRING

- A. Size wiring to conform to the exact requirements set forth by the equipment manufacturer.
- B. Splicing of system wiring shall be accomplished only in equipment back boxes, terminal cabinet or designated junction boxes.

3.4 CLEANING

- A. Clean scoreboards and timers under provisions of Section 01 73 00 – EXECUTION.
- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.5 DEMONSTRATION

- A. Advise Architect after equipment has been set in place, adjusted and all electrical connections are finalized.
- B. Test equipment prior to demonstration.
- C. After it is shown that the equipment is operable and all equipment is in place, provide qualified and trained personnel to demonstrate operation of equipment and instruct Owner in operating procedures and maintenance so that they will be fully knowledgeable of all operating and service aspects of scoreboard and timer system.

3.6 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

Section 11 66 53
GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install gymnasium dividers including all supporting channels and suspension rods, motorized lift unit and remote control devices.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction recycling.
- B. Section 05 12 00 - STRUCTURAL STEEL FRAMING
- C. Section 05 31 00 - STEEL FLOOR DECK
- D. Section 05 40 00 - COLD-FORMED METAL FRAMING
- E. Section 05 44 00 - COLD-FORMED METAL TRUSSES
- F. Section 05 50 00 - METAL FABRICATIONS: Steel angle supports for Gymnasium Dividers.
- G. Division 26 - ELECTRICAL: Electrical connections to motor unit, empty conduit from motor to control.

1.4 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets for mounting system, including electrical characteristics.
 - 2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
 - 3. Manufacturer's certificates: Certify that Products provided under this Section meet or exceed specified requirements.
 - 4. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.

5. Shop drawings: Installation details showing mounting conditions, clearances, dimensions, and electrical connections.
 6. Selection samples: Sample card indicating Manufacturer's full range of fabric colors available for selection by Architect.
 7. Verification samples: 12 by 12 inch samples of vinyl fabric and netting, illustrating material and finish.
- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:
1. Manufacturer's warranty.
 2. Maintenance information for curtain raising mechanism, and cleaning information for vinyl cloth and netting material.

1.5 WARRANTY

- A. Provide manufacturer's standard 2-year warranty which shall include coverage of divider surfaces from discoloration. Warranty is in addition to and not in lieu of, other liabilities which the Contractor may have by law or other provisions of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Porter Athletic Equipment Company, Product: "Model Number "90675-100".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Porter Athletic Equipment Company, Schiller Park, IL.
 2. Draper, Inc., Spiceland, IN.
 3. Performance Sports Systems, Anderson, IN.
 4. AALCO Manufacturing Company, St. Louis, MI.

2.2 VERTICAL LIFT DIVIDER CURTAINS

- A. Roll-fold divider, overhead supported, lift-type divider curtain meeting the following requirements:
1. Motor: Drive pipe power mechanism shall consist of a compensating type winch, 115 volt 60 cycle single phase reversible capacitor start motor capable of providing 20 feet/minute curtain operation, lubed-for life bearings, reversing magnetic contactor for remote control, .
 2. Control Station: One standard keyed three button momentary contact type; 24 volt circuit; recess mounted.
 3. Cables: 1/8 inch diameter galvanized steel aircraft cables which terminate in individual storage drums.
 4. Curtain:

- a. Bottom 8 feet of curtain is 18 ounce per square yard nylon or polyester reinforced vinyl, equal to Porter "Flexivide", with edge hems double welds, seams 1-1/2 inch full contact sealed seam. Sewn construction will not be permitted. Fabric shall be rot and mildew resistant and show minimum results of 300 pounds per inch tensile strength when tested in accordance with FS 191 and, have 100 pounds inch tear strength. Fabric shall have a Class I flame spread rating when tested in accordance with ASTM E84. Color shall be as selected from manufacturer's full available range.
 - b. Upper curtain: Vinyl coated polyester mesh approximately 50 percent open weave and weighing 9 ounces per square yard, equal to Porter "Fleximesh". Fabric shall have a minim tensile strength of 100 pounds/inch and be fire retardent. Color as selected by the Architect from the manufacturer's full available range of colors.
5. Curtain batten: Rigid-coupled 1.9 inch diameter tubular steel batten, with padding.
- B. Metal components finish: Manufacturer's standard enamel or powder coat finish, in White color.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install suspension framing, channels and hanging rods.
- B. Install gymnasium dividers in accordance with manufacturer's instructions. Secure units level and plumb.
- C. Adjust each unit for operating positions, accurately establish lowered position in place.

3.2 CLEANING

- A. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End of Section

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Section 11 95 13
KILNS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists providing electric kilns where shown on the Drawings, as specified herein, and as required for a complete and proper installation. Work includes, but is not limited to the following:
 - 1. Furnish and install electric kilns where indicated on the Drawings.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT: Procedural and administrative requirements for construction recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REPORTING: Special administrative and procedure requirements related to the Owner's *LEED v4, LEED for Building Design and Construction, LEED BD+C: Schools* rating system certificate goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Division 23 - HEATING, VENTILATING AND AIR CONDITIONING: Kiln ventilation systems, complete with ductwork, hangers, and insulation.
- D. Division 26 - ELECTRICAL: External wiring, not integral with the equipment furnished under this Section.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. UL: Approved individual equipment, and component, listings and standards.

1.5 SUBMITTALS

- A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder clearly indicating configurations,

sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.

2. Manufacturer's installation instructions: Indicate special procedures, perimeter conditions and conditions requiring special attention.
3. Manufacturer's certificates:
4. Certify that Products installed under this Section meet or exceed UL and specified requirements.
5. Manufacturer's sample warranties.
6. LEED Submittal Requirements:
 - a. Submit completed LEEDv4 Materials Reporting for applicable material requirements as required in Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS. Submit all required backup documentation.

- B. Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Operation Data for all installed and furnished equipment.
 2. Manufacturer's warranties: Include coverage of installed equipment.
 3. Maintenance Data: Include periodic maintenance requirement schedules.

1.6 QUALITY ASSURANCE

- A. Kiln manufacturer specializing in producing the work of this Section with a minimum of 5 years documented successful experience.
- B. Perform work to the following certification standards:
 1. Electrical wiring and components: Conform to UL standards.

1.7 REGULATORY REQUIREMENTS

- A. Provide and install the work of this Section in conformance with all applicable federal, state and municipal codes, laws and regulations regarding utilities, health, fire protection and safety.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with interfacing work. Ensure that the work performed is acceptable to respective trades responsible for interfacing work.

1.9 WARRANTY

- A. Additionally provide manufacturer's standard warranties under the provisions of Section 01 78 00 - CONTRACT CLOSEOUT that exceed the one year period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on "L & L Kiln Manufacturing, Inc., product "Easy Fire", model N°. e28T-3-208-3P.

- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. Skutt Ceramic Products, Inc., Portland, OR.
 2. L & L Kiln Manufacturing, Inc., Swedesboro, NJ.
 3. Olympic Kilns, by Haugen Manufacturing, Inc., Flowery Branch, GA.

2.2 KILNS

- A. Kiln: UL listed, multi-sectional, modular, ceramic kiln 29 inch interior diameter by 27 inches deep with a 10 cubic foot firing chamber with reversible lid and floor slabs and 3 inch firebrick walls.
1. Power requirements: 3 phase, 208 volt.
 2. Electrical rating: 39.8 amps, 14,340 watts.
 3. Temperature rating: Cone 022 to Cone 10.
 4. Thermocoupling: Type K.
 5. Control features: Touch pad type with digital readout with integral temperature scale selector, firing program review and preprogrammed cone tables having the following characteristics:
 - a. Delayed firing start controls: Delay up to 99 hours, 99 minutes.
 - b. Adjustable temperature alarm.
 - c. Cone firing mode: Programmable by Cone Number with cone range of Cone 022 to Cone 10.
 - d. Ramp/hold mode: Manual entry by temperature, allowing creation of custom programs from 1 to 8 segments with ability to specify the rate of heating or cooling within each segment and optional hold feature up to a maximum temperature of 2400° Fahrenheit.
 - e. Firing speeds: Slow, medium or fast settings for heating
 - f. Memory capacity: Store up to six firing programs.
 - g. Safety features: Power failure detection, thermocouple failure detection, microprocessor fault detection.
- B. Kiln Venting System having the following characteristics and components:
1. Materials: Stainless steel plenum, duct and blower housing.
 2. Power: 115 volt household current.
 3. Motor: 115 volt, 1.1 amp, 0.18 hp.
 4. Total airflow: 60 to 80 cfm.
 5. Provide 8 feet of 3 inch diameter flexible aluminum intake duct.
 6. Provide mounting plates for either floor mount or wall mounting allowing for field adjustment and drilling of mounting plate.
 7. Automatic control of kiln exhaust fan based on kiln operation.
 8. Provide fan proving switch for interlock to HVAC system.
- C. Provide rough-in hardware, supports and connections, attachment devices, and accessories.

PART 3 - EXECUTION

1.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Notify the Contractor, and copy to Architect, in writing of any conditions detrimental to the proper and timely completion of the work, and do not proceed with the work until said conditions are corrected.
- B. Verify clearances required for equipment.
- C. Verify ventilation outlets, service connections, and supports are correct and in required location.
- D. Verify that electric power is available and of the correct characteristics.
- E. Beginning of installation means acceptance of existing site conditions.

3.2 INSTALLATION

- A. Install each product in accordance with manufacturers' instructions.
- B. Sequence installation and erection to ensure correct mechanical and electrical utility connections are achieved.
- C. Anchor equipment using standard devices provided by the manufacturer appropriate for equipment, substrate and expected usage.

3.3 ADJUSTING

- A. Adjust work under provisions of Section 01 73 00 - EXECUTION. Adjust equipment and apparatus to ensure proper working order and conditions.

End of Section

Section 12 24 00
WINDOW SHADES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Chain driven, manually operated roller-screens for solar shading, privacy shading and A/V blackout.
 - 2. Supplementary items required for shade installation.

1.3 RELATED REQUIREMENTS

- A. Section 06 20 00 - FINISH CARPENTRY: Wood trim mounting substrate for blinds.
- B. Section 08 14 16 – FLUSH WOOD DOORS: Substrate for door mounted window shades.
- C. Section 09 29 00 - GYPSUM BOARD:
 - 1. Substrate for window shade systems.
 - 2. Patching existing finishes at window treatment.
- D. Section 09 51 00 - ACOUSTICAL CEILINGS: Relationship of window shades to acoustical ceilings.

1.1 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
 - 2. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

1.2 PERFORMANCE REQUIREMENTS

- A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated "FR".

1.3 SUBMITTALS

- A. Submit the following under provisions of Section 01330 - SUBMITTAL PROCEDURES:
1. Product Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
 - b. Note on submittals any deviations from specified requirements and the reasons thereof.
 2. Maintenance Information: Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 3. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
 4. Certifications:
 - a. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
 - b. Authorization for Deviations From Specifications: If any deviations from specifications have been accepted, include written description and reasons for deviations. Include authorization for change signed by Owner, Architect, Engineer, and person submitting change. Authorization for change shall also clearly indicate party responsible for remedying defects.
 5. Shop drawings:
 - a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.
 - b. Include complete fabrication details and erection drawings.
 6. Selection Samples:
 - a. 3 by 5 inch size shade cloth sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
 - b. Provide additional shade cloth samples, of size requested by Architect, to aid in the Architect's selection.
 7. Verification Samples:
 - a. 12 by 12 inch samples of blind fabric illustrating material and color.
 - b. 12 inch lengths of roller assembly.

1.4 QUALITY ASSURANCE

- A. Obtain shade operators and fabric products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of operator.

- B. Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

1.5 QUALIFICATIONS

- A. Installer, with a minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.
- C. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.
- D. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes.
- E. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner's Final Acceptance.

1.7 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.
- B. Sequence deliveries to avoid delays, but minimize on-site storage.

1.9 WARRANTY

- A. Furnish the following warranties under provisions of Section 01 77 00 - CLOSEOUT PROCEDURES.
- B. Manual operating components: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts, except for the bead chain which is not warranted.

- C. Shade cloth: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

1.10 EXTRA MATERIALS

- A. Provide to Owner, 1 percent extra shade fabric for each size, color and type installed.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on MechoShade, Long Island City, NY.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. MechoShade, Long Island City, NY.
 2. Draper Shade and Screen Co., Spiceland IN.
 3. Walker Specialties, Braintree, MA.

2.2 SHADE COMPONENTS

- A. General: Bi-directional clutch and beaded chain mechanism with adjustable brake to permit dynamic mode with predetermined stop positions or, static mode with infinite stop positions.
 1. Sprocket: One piece injection molded high density Delrin, capable of full engagement with ball chain.
 2. Control loop chain: endless bead chain, stainless steel or nickel-plated brass bead chain.
 - a. Plastic bead chain is not acceptable.
 3. Brake mount: Shake-proof steel and nylon vibration-resistant locking nut to maintain selected braking friction
 4. Self-Adjusting linear disc brake (flat steel backing plate is not acceptable as a substitution) with concealed tension adjustment device.
 - a. System shall consist of a compression spring with two friction-absorbing nylon washers on a 1/4" steel shaft which provides continuous uniform compensating brake pressure on the one-piece sprocket brake drive component with a braking surface of not less than 2.89 square inches
 - b. Provide a compression spring which also acts as a vibration absorber.
 5. Flexible offset drive, where required, with universal joint permitting up to 12 degree angle between any two shades with a single operator
 6. Provide all shades with chain hold down, spring-tension pulley and shock absorber.
- B. Rollers: Removable, 1-1/2 inch or larger diameter, extruded aluminum alloy 6063-T5 or alloy 6063-T6 tube with a minimum wall thickness of 0.065 inch.

1. Shade mounting spline: Extruded vinyl spline, enabling shade cloth to be removed without having to remove the tube from retainer brackets or without removing brackets from wall
 2. Tube Support: Delrin cover plate shall provide protection from tube dislocation. In the event the tube is pushed out of place, the Delrin end of the mounting plates shall contain the tube preventing the tube from falling out of the bracket.
- C. Roller idler assembly: Type 6/6 injected molded nylon or high-strength glass-fiber - reinforced polyester outside sleeve, with zinc plated steel pin.

2.3 SHADE FABRICS

- A. Solar /Privacy Fabric, PVC-Free: MechoShade EcoVeil, 1550 series, fabricated from thermoplastic olefin (TPO) for both core yarn and jacket, woven in a non-directional basket-weave, meeting the following minimal requirements:
1. Openness factor: 3 percent.
 2. Minimum thickness: 0.030 inch (0.762 mm).
 3. Color: As selected by Architect from manufacturer's standard colors.
 4. Fading:
 - a. UV test 200 sun-fade hours: no change.
 - b. UV test 500 sun-fade hours: maximum 5 percent change.
 5. Seamless up to 126 inch width.
 6. Flame retardant treated certified in conformance with NFPA 701, UL 214,.
 7. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
 8. Fabric warranty: Manufacturer's standard 10 year limited warranty.
- B. Opaque interior shades (includes shades at doors): PVC-free, polyester-fiber yarn coated with opaque acrylic backing comprising of 27% polyester yarn, 73% acrylic coating, equal to MechoShade "Midnite 0200 Series" meeting the following minimal requirements:
1. Openness factor: 0 percent, opaque.
 2. Minimum weight: 0.94 pounds per square yard.
 3. Seamless up to 126 inch width (320 cm).
 4. Flame retardant treated certified in conformance with NFPA 701.
 5. Color: As selected by Architect from manufacturer's standard colors.
 6. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
 7. Fabric warranty: Manufacturer's standard 10 year limited warranty.

2.4 MOUNTING SYSTEM

- A. Mounting: Wall, jamb, or overhead mounted as indicated, brackets made of 1/8 inch sheet steel to which drive assembly, idle end assembly and center support systems are attached.
1. Furnish center support brackets to meet span or weight requirements.

2. Components of brackets shall be interchangeable or replaced without removing bracket from wall or ceiling, inside or outside mount.
3. Metal support brackets cadmium plated steel. Custom color as selected by the Architect.

B. Housings:

1. Recessed housing, for acoustical tile ceilings and gypsum board ceilings with removable closure plate for access.
2. Roller is exposed at doors with lites.

C. Guide cables provide where recommended by manufacturer.

2.5 FABRICATION

- A. Fabrication: Fabricate units to completely fill existing openings, from head-to-sill and jamb-to-jamb. Do not commence fabrication of shade units until field measurements are confirmed.
- B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravel.

2.6 FACTORY FINISHES

- A. Aluminum: PPG Duracron baked enamel in standard colors.
- B. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section. Ensure that supporting substrate is adequate.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

3.3 TOLERANCES

- A. Maximum variation of gap at window opening perimeter: 1/4 inch.
- B. Maximum offset from level: 1/8 inch.

3.4 ADJUSTING

- A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.

3.5 CLEANING

- A. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

End Of Section

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Section 12 24 14
MOTORIZED WINDOW SHADES

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of motorized window shades where shown on the Drawings, as specified herein, and as required for a complete and proper installation.
- B. Furnish and install the following:
 - 1. Precision-controlled, electronic drive, group-controlled, single and dual roller-shades for solar shading/privacy/blackout shading as scheduled and indicated.
 - a. Provide motorized shade units at windows and skylights in Auditorium.
 - 2. Low voltage control systems, power controls (with appropriate voltage converters), including wall mounted controls.
 - 3. Supplementary items required for shade installation.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 06 10 00 - ROUGH CARPENTRY: Blocking for window shade systems.
- C. Section 06 20 00 - FINISH CARPENTRY: Wood trim mounting substrate for blinds.
- D. Section 09 29 00 - GYPSUM BOARD:
 - 1. Substrate for window shade systems.
 - 2. Patching existing finishes at window treatment.
- E. Section 12 24 00 – WINDOW SHADES: manual window shades.
- F. Division 26 - ELECTRICAL: Electrical supply wiring and switches.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to

establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.

1. NFPA 701 - Standard Methods of Fire Tests for Flame-resistance Textiles and Films.
2. NFPA 70 - National Electrical Code.
3. UL 214 - Standard for Tests for Flame Propagation of Fabrics and Films.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. General: Coordinate the work of this Section with the respective trades responsible for installing interfacing and adjoining work for proper sequence of installation, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

B. Sequencing:

1. Field Measurements
 - a. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - b. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.6 SUBMITTALS

A. Information and Review Submittals: Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:

1. Product Data: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions for each item furnished hereunder.
 - a. Provide additional information required for fabric, including: Size limitations, fire resistance information. Identify available shade cloth colors and materials.
 - b. Note on submittals any deviations from specified requirements and the reasons thereof.
 - c. Warranty: Provide sample copies of manufacturers' actual warranties for all materials to be furnished under this Section, clearly defining all terms, conditions, and time periods for the coverage thereof.
2. Shop Drawings:
 - a. Dimensioned 1/4 inch scale drawings, bearing dimensions of actual measurements taken at the project, where practical.
 - b. Include complete fabrication details and erection drawings.
 - c. Wiring Diagrams and Schematics: Submit detailed wiring diagrams and schematics of the entire system, and each component of the system with a detailed list of the components, wiring schematics, and operational characteristics at every level of operation.
3. Selection Samples:

- a. 3 by 5 inch size shade cloth sample swatches indicating Manufacturer's full range of colors and patterns available for initial selection.
 - b. Provide additional shade cloth samples, of size requested by Architect, to aid in the Architect's selection.
 4. Verification Samples:
 - a. 12 by 12 inch samples of blind fabric illustrating material and color.
 - b. 12 inch lengths of roller assembly.
 5. Certificates:
 - a. Manufacturer shall submit notarized certificate indicating compliance with requirements of specifications and that specified warranty will be provided without restriction.
 - b. Certification of compliance with current building code and environmental regulations: Manufacturer shall certify that materials proposed for use comply with applicable building code and environmental regulations.
 - c. Authorization for Deviations From Specifications: If any deviations from specifications have been accepted, include written description and reasons for deviations. Include authorization for change signed by Owner, Architect, Engineer, and person submitting change. Authorization for change shall also clearly indicate party responsible for remedying defects.
 6. Manufacturer Reports:
 - a. Certify the shade system is fully compatible with the existing electrical design.
- B. Closeout Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
 1. Operation and Maintenance Data:
 - a. Fabric maintenance data and recommended cleaning materials, and cleaning and stain removal methods.
 - b. Motor and control wiring diagrams.
 2. Bonds and Warranty Documentation:
 - a. Manufacturer's Warranties and Guarantees as specified elsewhere herein this Section.
- C. Maintenance Material Submittals: Submit the following under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS. Clearly label and package extra materials securely to prevent damage.
 1. Extra Stock Materials: Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to one percent shade fabric for each size, each color, finish and type installed.

1.7 QUALITY ASSURANCE

- A. General: Notify the Architect where conflicts apply between referenced standards and existing materials, and existing methods of construction.

- B. Sole Source: Work of this Section 12 24 14 and Section 12 24 00 –WINDOW SHADES shall be from a single manufacturer including all shade operators and fabric products.
- C. Qualifications:
 - 1. Installer/Applicator: Minimum of 3 years documented experience demonstrating previously successful work of the type specified herein.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Delivery and Acceptance Requirements:
 - 1. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
 - 2. Do not deliver shades to the project until all concrete, masonry, plaster and other wet work has been completed and is dry.
 - 3. Deliver prefabricated shades to site in labeled protective packages, uniquely identified for each intended location. Schedule delivery of panels to prevent delays of the Work, and minimize on-site storage.
- B. Storage and Handling Requirements:
 - 1. Store materials in manner recommended by shade manufacturer, inside, under cover, and in manner to keep them dry, protected from moisture, direct sunlight, excessive temperatures, surface contamination, corrosion and damage from construction traffic and other causes.
- C. Packaging Waste Management: Comply with disposal and recycling requirements specified under Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

1.9 SITE CONDITIONS

- A. Maintain ambient temperature between 60 and 85 degrees Fahrenheit, and a relative humidity between 20 and 50 percent for a period starting 24 hours before installation of window shades, and maintain until Owner's Final Acceptance.

1.10 WARRANTY

- A. General: Submit the following warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS, and in compliance with Section 01 78 36 – WARRANTIES.
- B. Manufacturer Warranty:
 - 1. Operating components: Manufacturer's 2 year parts and labor, and limited 8 year parts warranty from Date of Substantial Completion of shade installation. Warranty shall include provisions that installation shall remain operational without fault and include all operating parts.
 - 2. Motorized components: Manufacturer's 1 year warranty from Date of Substantial Completion of project. Warranty shall include provisions that installation shall remain operational without fault for the warranty period including coverage of motor, electrical controls and override circuits.

3. Shade cloth: Manufacturer's 10 year warranty from Date of Substantial Completion of shade installation. Warranty shall include provision that shade cloth will not fade, deteriorate, sag or warp for the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on MechoShade, Long Island City, NY., product: "Electroshade Electro 3".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. MechoShade, Long Island City, NY.
 2. Draper Shade and Screen Co., Spiceland IN.
 3. Walker Specialties, Braintree, MA.

2.2 DESCRIPTION

- A. General Description:
 1. Allow for all windows within designated space to be integrated under single gang controls. Work scope includes roller shades, drive units, pockets and fascia, shade controls, and power supplies.
 2. Control shade speed for tracking within plus or minus 0.0625 inch throughout entire travel.
 3. Include 10 year power failure memory for preset stops, open and close limits, shade grouping and subgrouping, and system configuration.
 4. Systems with multiple electronic drive units electronically synchronized to start, stop, and move in unison.

2.3 PERFORMANCE/DESIGN CRITERIA

- A. Fire performance characteristics; shade material tested in accordance with NFPA 70 1- Vertical Burn Test, rated "FR".
- B. Electrical control equipment must be wired in accordance with the shade manufacturer's wiring diagrams and in accordance with the National Electrical Code and local codes.

2.4 OPERATION

- A. Grouping:
 1. Keypads and contact closure inputs can control any electronic drive unit without separate group controller.
 2. System groups and subgroups configured at point of control without rewiring and without access to electronic drive unit.
 3. System may contain multiple electronic drive units.

4. Keypads and interfaces able to operate any group or subgroup of electronic drive units.
- B. Integration:
1. Electronic drive units integrate with lighting controls by same manufacturer without interfaces.
 2. Contact closure, RS232, RS-485, dry contact closures and Ethernet interfaces available to interface with lighting systems, audio/visual equipment, and security systems.
- C. System Controls:
1. Shades controlled by built-in shade columns on lighting control or by keypad.
 2. Electronic drive units, keypads, and lighting controls contain microprocessors, allowing high level programming from any source.
 3. System devices, including shades and lighting controls, connected through common communication link.
- D. System Performance:
1. One-touch control of shades by means of keypad, lighting control, or infrared remote, as determined by Architect during shop drawing phase.
 - a. Provide separate controls, for either side of folding partition.
 2. Capable of stopping within accuracy of 0.125 inch at any point between open and close limits.
 3. Store over 250 programmable stop points, including open, close, and any other position.
 4. Presets set by 5-second button push and hold from keypad, lighting control, or handheld remote control.
 5. Presets recalled by keypad, contact closure input, infrared receiver, or other lighting control system interface.
 6. Open and close limits programmable from electronic drive unit, lighting control, wall-mounted keypad, or handheld remote control.
 7. System components electro static discharge protected.

2.5 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.6 COMPONENTS

- A. Mounting Brackets: Two-piece mounting bracket providing level, projection, and shade centering adjustments from mounting bracket. Zinc chromate finished 16 gage steel in manufacturer's standard configuration for head or wall mounting.
1. Brackets to provide symmetrical light gaps of 0.75 inch on each side of shade.
 2. Roller shade leveling adjustment allowing leveling adjustment while roller shades are mounted to brackets.
 3. Allow side-to-side adjustment up to 0.375 inch on each side while shade is mounted to bracket.

4. Projection adjustment up to 0.50 inch.
5. Coupling:
 - a. Single electronic drive unit capable of driving multiple shades with coupling pin.
 - b. Pin allows for precision adjustment of bottom bar levels without removing roller from installed point or fabric from roller tube.
- B. Rollers: Removable, 1-1/2 inch or larger diameter, extruded aluminum alloy 6063-T5 or alloy 6063-T6 tube with a minimum wall thickness of 0.065 inch.
 1. Shade Tube: Fabric connected to tube using double-sided adhesive strip with minimum of one turn of fabric on roller before working section of fabric starts.
 2. Tube Support: Delrin cover plate shall provide protection from tube dislocation. In the event the tube is pushed out of place, the Delrin end of the mounting plates shall contain the tube preventing the tube from falling out of the bracket.
- C. Black-out side channels; extruded aluminum with polybond edge seals, and snap-loc mounting brackets;
 1. Jamb channels, 2-1/2 inches wide by 1-3/16 inches deep; double jamb channels 5 inches wide by 1-3/16 inches deep.

2.7 SHADE FABRICS

- A. General:
 1. Shadecloth material shall hang flat without buckling or distortion. The edge when trimmed shall hang straight without raveling. The unguided shade band shall roll up true and straight, without shifting sideways more than 1/8 inch in either direction due to warp distortion or weave design.
 - a. Where applicable, seal shade fabric or treat PVC-coated fabric edges to prevent fraying.
 - b. Woven yarn fabrics will be interlocking and heat-treated so that all material is securely bonded.
- B. Fabric Material - General:
 1. Flame retardance: Certify shadecloth that it will pass the following:
 - a. NFPA 701, both large and small scale burn requirements
 - b. CFR Title 16, Consumer Product Safety Commission, Flammable Fabrics Act.
 - c. State of California, and municipal fire retardance requirements of New York, Boston and Chicago.
 2. Bacterial Growth: Minimum 5 mm "No Growth Contact Area", tested to ASTM G22 for ATCC6538 (*Staphylococcus aureus*) and ATCC13388 (*Pseudomonas aeruginosa*).
 - a. No growth, tested to ASTM G21 for ATCC9642, ATCC9348, and ATCC9645.

-
- C. Black Out Fabric: PVC-free, Glass-fiber yarn coated with opaque acrylic backing comprising of 34% fiberglass, 66% acrylic coating, equal to MechoShade "Equinox 0100 Series" meeting the following minimal requirements:
1. Openness factor: 0 percent, opaque.
 2. Minimum weight: 0.94 pounds per square yard.
 3. Seamless up to 98 inch width (249 cm).
 4. Flame retardant treated certified in conformance with NFPA 701.
 5. Color: As selected by Architect from manufacturer's standard colors.
 6. Hem pocket: Provide hem pocket, heat sealed or sewn with bottom weight enclosed.
 7. Fabric warranty: Manufacturer's standard 10 year limited warranty.

2.8 ELECTRIC OPERATION

- A. Shade Motors:
1. Quiet [44 – 46 db] Intelligent Encoded Motor and Control System: Tubular, asynchronous (non-synchronous) motors, with built-in reversible capacitor operating at 110v AC (60hz), (230v/50 hz AC) single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
 2. Conceal motors inside shade roller tube.
 3. Maximum current draw for each shade motor of 2.3 amps @ 110 V (.9 amps @230 V AC).
 4. Use motors rated at the same nominal speed for all shades in the same room.
- B. Total hanging weight of shade band shall not exceed 80 percent of the rated lifting capacity of the shade motor and tube assembly. Spring assisted lift systems shall not be accepted.
- C. Encoded Motor System:
1. Programmable positioning system.
 2. Method of control: low-voltage control integrated with lighting and Audio/Visual systems.
- D. Uniform or Regular Modes of Operation:
1. Uniform mode shall allow for shades to only move to intermediate stop positions.
 2. Regular mode shall allow for shades to move to both intermediate stop positions, plus any position desired between the upper and lower limits as set by the installer.
- E. Wall Switches:
1. IQ-Switch: in 5 or 10 button, single gang, low voltage.
- F. Expandable IQ-485-NI: Available when addressability of each motor or group of motors are required to be on a two-way addressable communication network for whole building or overlapping multi-level control. System Features include:

1. 5 @ IQ, Local or Master ports
2. 1 @ Photocell input for automated control of shades
3. 1 @ IR Eye Input for wireless remote control of shades
4. Software Addressable IQ Ports support Multi-Level control with 8 addresses per port
5. IQ-485 MS Bus, 485 shall allow up to 65000 addresses controlling up to 500,000 motors per network
6. Shall allow for variety of switch and other user interface options including RF and Ethernet (IP)
7. Shall support third party control integration via RS232 and Ethernet (IP)

2.9 SHADE FABRICATION

- A. Fabrication: Fabricate units to completely fill window openings, from head-to-sill and jamb-to-jamb. Do not commence fabrication of shade units until field measurements are confirmed.
- B. Fabric shall hang straight and flat without buckling or distortion. Fabric edges shall be straight and without ravel. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shade cloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
 1. Bottom hem weights.
 2. Concealed hemtube.
 3. Exposed hemtube with side and back guide cable capability; hembar may be attached and demounted from the cable with out removing or loosening the cables.
- C. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shadebands. Contractor shall be responsible for assuring the width-to-height (W:H) ratios shall not exceed manufacturer's standards or, in absence of such standards, shall be responsible for establishing appropriate standards to assure proper tracking and rolling of the shade cloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.
- D. For railroaded shadebands, provide seams in railroaded multi-width shadebands as required to meet size requirements and in accordance with seam alignment as acceptable to Architect. Seams shall be properly located. Furnish battens in place of plain seams when the width, height, or weight of the shade exceeds manufacturer's standards. In absence of such standards, assure proper use of seams or battens as required to, and assure the proper tracking of the railroaded multi-width shadebands.
- E. Provide battens for railroaded shades when width-to-height (W:H) ratios meet or exceed manufacturer's standards. In absence of manufacturer's standards, be responsible for proper use and placement of battens to assure proper tracking and roll of shadebands.

2.10 FINISHES

- A. Aluminum: PPG Duracron baked enamel in standard colors.
- B. Steel parts, cadmium plated, satin finished, or bonderized prior to painting with baked enamel finish.

2.11 ACCESSORIES

- A. Wall Mounted Controls:
 - 1. Low voltage keypads with faceplates attached without visible means of attachments, product color to match NEMA WD1, with backlit buttons.
 - 2. Visible parts ultraviolet color stabilized, tested to ASTM D4674.
 - 3. Type: Three button with raise/lower. Provide dual three button for dual mount or two group applications.
- B. Power Supplies:
 - 1. Electronic drive units powered with 24 VDC from approved power supply; power supply via NEC Class 2 power source.
 - 2. Provide power panel including 10 individual outputs.
- C. Shade pockets (where indicated): Custom fabricate brake-formed aluminum shade pockets to dimensions indicated on Drawings, as manufactured by Gordon Inc., Bossier City LA, with Gordon "Acrogard Enhanced Powder Coat Finish". Provide factory-welded ends and corners.
- D. Fascia (at non-recessed locations): One-piece extruded aluminum 6063-T5 alloy with average thickness of 0.062 inches, snap-loc clipped to the brackets without the use of glue, magnetic strip or screws, concealed fastening.
 - 1. Offset Drive - No Notch Fascia: Chain drive shall fall behind the return edge of the fascia without notching or otherwise defacing the return leg of the fascia.
 - 2. Fascia filler; readily removable to bridge mullions, transition piece between shades in same material and finish as fascia panel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 - 1. Beginning of installation means acceptance of existing substrate and project conditions.
- B. Preinstallation Testing:
- C. Evaluation and Assessment:

3.2 PREPARATION

- A. Protection of In-situ Conditions: During the operation of work of this Section, protect surrounding materials and finishes against undue soilage and damage by the exercise of reasonable care and precautions. Clean, or repair all existing

surfaces which are soiled or otherwise damaged by Work of this Section, to match indicated profiles and specified finishes. Materials and finishes which cannot be cleaned, or repaired shall be removed and replaced with new work in conformance with the Contract Documents.

3.3 INSTALLATION

- A. Install units to comply with manufacturer's instructions for type of mountings and operations required. Provide units plumb and true, securely anchored in place with recommended hardware and accessories to provide smooth, easy operation.

3.4 TOLERANCES

- A. Maximum variation from plumb or level: 1/4 inch.
- B. Maximum offset from true dimensional alignment: 1/8 inch.

3.5 ADJUSTING

- A. Adjust units for smooth operation. Replace any units or components which do not operate smoothly and without hindrance.
 - 1. Adjust level, projection, and shade centering from mounting brackets.
 - 2. Adjust fabric on tube if visibly telescoping.

3.6 CLEANING

- A. General: Clean work under provisions of Section 01 70 00 – EXECUTION.
- B. Daily clean work areas by sweeping and disposing of debris, and scraps.
- C. Upon completion of the work of this Section in any given area, remove tools, equipment and all rubbish and debris from the work area; leave area in broom-clean condition.
- D. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.7 PROTECTION

- A. Protect finished work under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 12 35 53
LABORATORY CASEWORK

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. This section specifies all work and materials for casework of types and sizes shown on the Drawings, as specified herein. The types of work of this section includes, but is not limited to:
 - 1. Plastic laminate laboratory casework, including wall and base cabinets and vent connections for fume hoods.
 - 2. Shelving systems including metal supports,
 - 3. Furnish electrical service fixtures, including nipples, required for mounting in or on equipment. Furnish all fixtures unattached and unassembled to the Electrical Trade Contractor properly tagged and identified with installation information.
 - 4. Install access panels where required for mechanical and electrical work.
 - 5. Casework manufacturer is responsible for all plumbing cutouts except as otherwise indicated herein.
 - 6. Coordinate work with Section 12 36 53 - LABORATORY COUNTERTOPS.
- B. Make all cutouts within casework items to accommodate sinks, piping, conduit, and other mechanical and electrical work, from templates provided by the respective mechanical and electrical trades.
- C. Furnish and provide all materials and services as may be additional or separately described under other Sections of this Specification.
 - 1. No attempt is made in this Section to list all elements of casework required on this project or to describe how each element will be installed. It is the responsibility of the Construction Manager to determine for itself the scope and nature of the work required for a complete installation from the information provided herein and in the Drawings.
- D. Remove all debris, dirt and rubbish accumulated as a result of this installation, and leave the premises clean and ready for use. This shall include cleaning equipment interiors, exteriors, and worktops.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 10 00 - ROUGH CARPENTRY: Wood blocking
- D. Section 06 40 00 - ARCHITECTURAL WOODWORK: Custom millwork and related countertops.
- E. Section 09 29 00 - GYPSUM BOARD. Gypsum board surfaces adjacent to wall and base cabinets and backsplashes.
- F. Section 11 53 00 - LABORATORY EQUIPMENT.
- G. Section 11 53 13 - LABORATORY FUME HOODS
- H. Section 12 36 53 - LABORATORY COUNTERTOPS: Epoxy laboratory countertops and integrated epoxy sinks.
- I. Division 22 - PLUMBING. Plumbing occurring in casework.
 - 1. Stainless steel sinks, plumbing and gas fixtures and fittings shall be furnished and installed under Section 22 00 00 - PLUMBING, except for pre-plumbed casework and laboratory equipment.
- J. Division 26 - ELECTRICAL: Wiring, fixtures and lighting occurring in casework.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - References. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM C 209 - Test Methods for Cellulosic Fiber Insulating Board.
 - 2. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
 - 3. ASTM D 523 - Standard Specification for Specular Gloss.
 - 4. ASTM D 1037 - Test Methods of Evaluating Properties of Wood-Base Fiber and Particle Panel Materials.
 - 5. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials.
 - 6. AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
 - 7. APA Grades and Specifications.
 - 8. National Lumber Grades Authority, American Lumber Standards, and Grading Rules and Standards of the various lumber associations whose species are being used, with grade-marks for same.

9. U.S. Department of Commerce Simplified Practice Recommendation R-16, for sizes and use classifications of lumber; and Product Standard (PS):
 - a. PS-1 - Construction and Industrial Plywood Standard.
 - b. PS-20 - American Softwood Lumber Standard.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties and installation instructions.
 - a. Submit test data on chemical resistance of epoxy resin tops
 2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - a. Chain-of-Custody: Written documentation providing evidence of compliance with Chain-of-Custody supply of wood products, and compliance with FSC standards.
 - 1) Demonstrate that products are FSC-certified by providing vendor invoices. Invoices will contain the vendor's chain of custody number and identify each chain of custody certified product on a line-item basis. A "vendor" is defined as the company that furnishes wood products to project contractors and/or subcontractors for on-site installation.
 - b. Urea-formaldehyde Resins: Written documentation certifying that all composite wood and agrifiber products used on this Project contain no added urea-formaldehyde.
 - 1) Written certification from Millworker, that only "no added urea-formaldehyde" manufactured composite panel products are incorporated into the Work, including all concealed components. Composite panel products include but are not limited to particle board (PB), Medium Density Fiberboard (MDF) and similar manufactured products.
 - 2) Written certification from Millworker that laminating adhesives used in product fabrication on or off site do not contain any added urea-formaldehyde resins.
 3. Materials schedule: A complete schedule of casework components, coordinated with the Contract Drawings.
 4. Manufacturer's instructions for resin tops: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
 5. Shop Drawings in sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 6. Selection samples:
 - a. Sample card indicating Manufacturer's full range of wood veneer stains, colors of laminate, edging or other surfacing material, available for selection by Architect.
 - b. Provide additional samples as requested by Architect for initial selection of colors and finishes.

7. Verification samples:
 - a. Complete sample base cabinet unit of each type specified, 24 inches wide, with at least one door with specified hardware including lock, and one drawer with specified hardware and slide. Sample shall show full construction of all joints in casework and sample joint in worktop. Reviewed and accepted sample will be used for the purpose for establishing a quality control standard, and may not be incorporated into the work.
 - b. Sample of each type of hardware in specified finish.
8. Sustainable Design Submittals:
 - a. Adhesives: Include certification of data indicating Volatile Organic Compound (VOC) content of all field-applied adhesives. Submit MSDS highlighting VOC limits.
 - b. Sealants: Include certification of data indicating Volatile Organic Compound (VOC) content of all joint sealants. Submit MSDS highlighting VOC limits.
 - c. Recycled content: Provide manufacturer's written certification of recycled content. Indicate post-consumer and pre-consumer recycled content and provide documentation certifying products are from recycled sources.
 - d. Regional materials: Indicate location of content of extraction, harvesting, and recovery; indicate the distance between extraction, harvesting, and recovery and the project site. Indicate percentage of product content from qualified locations. Indicate location of manufacturing facility; indicate distance between manufacturing facility and the project site (MA-CHPS Credit MW.c5.1).

1.6 QUALITY ASSURANCE

- A. Joinery: All joinery work performed under this Section shall be of Premium Quality Grade, as defined in the current edition, of the AWI (Architectural Woodwork Institute) Architectural Woodwork Standards.
- B. Cabinet Finishes:
 1. Performance Tests: Chemical spot test shall be made by applying 10 drops of each reagent to the surface at 77 degrees F. and covered with an upright wide mouth bottle, 2 oz. capacity, to regard evaporation. Spot tests of volatile solvents marked with an * shall be tested as follows: A one inch diameter ball of cotton shall be saturated with the solvent and placed on the surface to be tested and covered with an inverted wide mouth bottle, 2 oz. capacity, to regard evaporation and keep the surface wet with solvent for duration of tests. All reagents shall remain on the surface for a period of one hour. At the end of the test, bottles are removed, excess solvents swabbed with cotton ball, and entire test surface rinsed thoroughly, dried carefully and examined. There shall be no effect other than slight discoloration, change of gloss, or temporary slight softening of the film.
 - a. Reagents Used:

Hydrochloric Acid, 37%	Methyl Alcohol*
Sulfuric Acid, 55%	Ethyl Alcohol*
Nitric Acid, 30%	Ethyl Acetate*

Acetic Acid, Glacial	Acetone*
Phosphoric Acid, 75%	Methyl Ethyl Ketone*
Ammonium Hydroxide, 28%	Benzene*
Sodium Hydroxide, 10%	Toluene*
Gasoline*	Chloroform*
Naptha*	Carbon Tetrachloride*

2. Heat resistance: Hot water (190 degrees-205 degrees) shall be allowed to trickle onto the surface, which shall be set at an angle of 45 degrees from horizontal for a period of 5 minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water.
3. Moisture resistance: A cellulose sponge (2 inches by 3 inches by 1 inch) shall be soaked with water and place on the surface of the finish for a period of 100 hours. The sponge shall be maintained in a wet condition throughout duration of tests. At the end of the test, the surface shall be dried and upon examination, shall show no blushing or whitening of the finish.
4. Impact resistance: A one pound steel ball (approximately 2 inches in diameter) shall be dropped for a distance of one foot onto the finished surface of a ¼ inch thick plywood panel supported underneath by solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close examination.

1.7 FIELD MEASUREMENTS

- A. Field dimensions: The casework vendor is responsible for details and dimensions not controlled by Project conditions and shall show on his shop drawings all required field measurements beyond his control.
 1. The Construction Manager shall acknowledge the casework vendor's need for accurate field dimensions prior to custom fabrication.
 2. The Construction Manager and the casework vendor's shall cooperate to establish and maintain these field dimensions.
 3. The casework vendor shall verify confirm all dimensions at the Project site relative to casework, all, and bring any significant discrepancies to the attention of the Architect prior to casework fabrication.
 4. The casework vendor shall provide all necessary closures/fillers, and extended stiles, face frames tops, sides, bottoms as required to interface with existing building's curved geometry.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.9 PRODUCT HANDLING

- A. Delivery and Storage: Deliver materials under protective cover and store within dry enclosed space.

- B. Protection: Use all means necessary to protect materials of this Section during transition, before, during, and after installation and to protect installed work and materials of all other trades.
 - 1. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes.
 - 2. Do not deliver casework to site until all concrete, masonry work is dry. Do not begin installation until veneer plaster has fully cured and is dry.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

1.10 WARRANTY

- A. Provide manufacturer's two year warranty against all defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS/PRODUCTS

- A. Specified manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Thermo Fisher Hamilton, Two Rivers, WI. Moderate and reasonable variations of manufacture or products of other manufacturers will be considered, upon Architect's approval.
 - 1. Cabinet sides and base cabinet bottoms, shelves, wall case tops and bottoms, tall case bottoms and tops are to be veneer core plywood; particleboard is not acceptable.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Thermo Fisher Hamilton, Two Rivers, WI.
 - 2. Kewaunee Scientific Corporation, Statesville, NC.
 - 3. CIF Lab Solutions, Vaughan, Ontario, Canada.
- C. Source Quality Control: The Manufacturer furnishing laboratory cabinetry specified under this Section shall also provide fume hoods specified under Section 11 53 13 - LABORATORY FUME HOODS.

2.2 MATERIALS, GENERAL

- A. General Requirements: In general, all materials shall be the best of their respective kinds for the purpose intended and all methods used in construction shall conform to the best practices of the Scientific Laboratory Equipment Industry, including any specialized materials required.
- B. Casework material:
 - 1. Vertical exterior plastic laminate: GP28 vertical surface grade high-pressure laminate for exposed cabinet and table frame surfaces. Color /pattern matching wood-grain finish selected in Section 06 40 00.

2. Typical core: Mattformed three layer medium density wood particle panel (PB), graded M2 per ANSI A 208.1 with a minimum density of 48 pounds per cubic foot or equivalent hardwood plugged plywood complying with PS 51-71.
 - a. "No Formaldehyde Added": Provide board which is fabricated using pre-consumer recycled wood fibers and an exterior-grade urea-formaldehyde free resin binder. Product shall contain no formaldehyde additives. Acceptable products include the following or approved equal.
 - 1) Collins Pine Company (distributed through Panel Source International, Tacoma WA), product: "PureKor Particleboard Plus"
 - 2) Plummer Forest Products, Post Falls ID, product "PFP particleboard".
 - 3) Rodman Industries, Oconomowoc, WI, product: "Rodman Resincore I".
 - 4) SierrePine Inc., Martel, CA, product "Encore SDP"
3. Casework end panels which extend to floor and similar wet conditions: Moisture resistant medium density fiberboard (MDF) conforming to ANSI A208.2 product class MD, fabricated from 100 percent pre-consumer recycled fiber, using formaldehyde free polyurethane/synthetic resin such as methyl diisocyanate (MDI) or (pMDI), having a minimum density of 44 pounds per cubic foot.
 - a. Acceptable products include the following:
 - 1) SierrePine Inc., Moncure, NC., product "Medex".
 - b. Thicknesses:
 - 1) Typical: 3/4 inch thick panels, except as otherwise indicated.
4. Backing sheet: White thermofused melamine except high-pressure cabinet liner to be used to balance a plastic laminate surfaced panel.
5. Plywood: 7-ply minimum, 3/4 inch veneer core plywood with cross and face plies bonded with Type II water resistant glue; drawers are 9-ply, 1/2 inch.
6. Hardboard: Wood fibers and resin binders formed under heat and pressure.
7. Glue: Laminating; Type II water resistant; assembly; Type III water resistant.
8. Edgebanding: Apply edgebanding with hot melt adhesive. PVC thickness for cabinet body edges to be .5 mm.

2.3 CABINET HARDWARE

- A. Provide finish hardware units as indicated, in satin finish stainless steel US32D.
- B. Hinges: Hinges shall be the five (5) knuckle institutional, offset type for all swinging doors. Hinges shall be 2-1/2 inches long, one (1) pair for doors under 4 ft. in height and 1-1/2 pair on doors over 4 ft. in height. Hinges are mounted with flathead screws, so applied to door and cabinet to withstand a weight load of 150 lbs. minimum. All hinges shall be satin finish stainless steel.
- C. Pulls: Offset type staple-shape wire pull, 4 inches long, 3/8 inch diameter, clear anodized aluminum with brushed finish, with one-inch finger clearance.
- D. Locks: Equal to National Lock "Remove-A-Core" 5-disc tumbler, heavy duty cylinder type. Exposed lock noses shall be dull nickel (satin) plated and stamped with identifying numbers. Locks shall have capacity for 225 primary key changes.

- Master key one level with the potential of 40 different, non-interchangeable master key groups
1. Provide three keys for each lock.
 2. Provide locks where indicated on Drawings. Coordinate keying requirements with Architect.
 3. Strike plates finish 26D.
- E. Drawer Slides: As manufactured by Accuride, Santa Fe Springs, CA., or approved equal. Model numbers are as follows for each type of application:
1. Standard Drawers: Accuride model 3832, full extension drawer slide, 100 pound capacity, clear zinc finish.
 2. File Drawers and deep drawers (greater than 12 inches deep): Accuride model 4034, full extension drawer slide, 150 pound capacity, clear zinc finish.
- F. Roller Catches: Roller catches shall be used on swinging doors. Catches shall have a spring loaded polyethylene roller and provided with a steel strike plate. Double doors without locks shall have catch on each door. Full height cases shall have latching devices located on the structurally fixed center shelf. Left hand door shall have a positive catch and left hand door shall have the lower type catch.
- G. Elbow Catches: Elbow catches and strike plates shall be used on left hand doors of double door cases where locks are used, and are to be steel, cadmium plated.
- H. Adjustable Shelf Supports: BHMA B84072, wrought steel, mortise mounted.
- I. Shelf Support Clips: Shelf support clips shall be pin type for mounting on interior of cabinet work. Coated finish, shall prevent corrosion, and retain shelves from accidental removal. Shelves are adjustable on 1-1/4 inch centers. Surface mounted metal support strips and clips subject to corrosion are not acceptable.
- J. Support Rods, Upright Rod Assemblies and Rod Sockets: Upright rods, cross rods and ring support rods, where specified, shall be anodized Duralumin (1/2 inch or 3/4 inch dia., as required). Rod sockets shall be chrome plated brass, secured through table tops with lock nut and spring washer. Rod clamps shall be heavy duty, designed to securely hold rod assembly in any position. Use of wood rod assemblies will not be acceptable.
- K. Leg Shoes: Leg Shoes shall be provided on all table legs, unless otherwise specified, to conceal leveling device. Shoes shall be 2-1/2 inch high and a pliable, black vinyl material. Use of a leg shoe which does not conceal leveling device will not be acceptable.
- L. Label Holders: Label holders, when specified, shall be self adhesive type aluminum with satin finish and designed for 2-1/2 by 1-1/8 inch cards, unless otherwise indicated.
- M. Number Plates: None Required.
- N. Leveling Devices: Leveling devices shall be furnished only where shown or specifically called for, and shall be adaptable to table legs or the bottom corners of base cabinets. Device shall consist of a 1/2 inch dia. bolt threaded through a 1/2 inch tee nut which is securely screwed to bottom of leg, or to 1-5/8 inch U-shaped 12

gauge metal bracket with leveling bolts mounted at the four bottom corners of a base cabinet. Bolts shall be cadmium plated steel with a hexagonal head to provide bearing against a 12 gauge flat steel floor plate. Bolts shall be accessible for adjustment through cupboard bottoms and drawer openings when installed on base cabinets.

- O. Floor Glides: Provide for open-leg and pedestal tables, shall be a non-marring material at least 1-1/2 inch dia. to prevent indenting composition flooring and shall have at least a 5/8 inch height adjustment. Use of metal buttons will not be acceptable.
- P. Base Moldings: Provided under Section 09651 - Resilient Base and Accessories.
- Q. Auxiliary Support Struts: Support struts shall consist of two 16 gauge channel uprights fastened top and bottom by two adjustable "U" shaped spreaders, each 1/8 by 1-1/2 inch by length required. Struts shall be furnished to support drain troughs and fume hood superstructures, or other abnormal loads. When specified, struts can be furnished with hangers to support mechanical service piping and drainlines.
- R. Grilles:
 - 1. Construction: Extruded aluminum face bars on 1/2 inch centers parallel to the long dimension; 0 degree deflection; 1 inch nominal frame border with countersunk face screw mounting holes; stainless steel square drive screw fasteners. Provide aligning pins to join multiple sections together for continuous appearance.
 - 2. Acceptable Manufacturers and products: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - a. Metalaire, Clearwater, FL, product: "Series 2000 Linear Bar Grilles".
 - b. Airflex Industrial Corp, Farmingdale, NY, product: "#2004 Bar Grilles".
 - c. Register & Grille Mfg. Co., Inc., Brooklyn, NY, product: "#EP25SE10 Flange Grille".
 - d. Dayus Register & Grille, Windsor ON, Canada, product: "DABL" Bar Linear Grilles.

2.4 CASEWORK FABRICATION

- A. Base units:
 - 1. Cabinet ends: 3/4 inch thick particleboard (for both exposed and concealed ends) with banding on front edges. Bore interior faces, as appropriate, for security panels, rails, and four rows of shelf support holes. Ends to be balanced panel construction.
 - 2. Backer panel: Full depth, 3/4 inch particleboard, banded front edge, and balanced surfaces, doweled to both end panels. None on sink or fume hood units.
 - 3. Intermediate rails: All drawer units 36 inches or wider come standard with one intermediate front rail to act as a spacer between end panels.
 - 4. Toe base: Veneer core plywood in 8 foot lengths. Construct on job-site separate from base unit.

5. Bottoms: 3/4 inch thick particleboard, set flush and joined to cabinet end panels with glued 8mm dowels and metal fasteners. Front edge to be banded. Suspended unit bottoms to be 1 inch thick. Balanced surfaces.
 - a. Removable bottoms are not acceptable.
 6. Backs: 3/16 inch thick fused melamine hardboard; suspended units have 3/4 inch thick melamine particleboard panel, doweled into ends, balanced surfaces:
 - a. Cupboard units: One-piece, captured at subtop and bottom.
 - b. Drawer units:
 - 1) Two-piece behind drawers on units.
 - c. Sink units: Half-height, one-piece hardboard, rabbeted into rear rail for easy removal from inside of cabinet.
 7. Vertical dividers in combination cabinets: 1-1/2 inch thick particle board panel (frames not permitted) glued and screwed in place, top and bottom with edgebanding on front edge.
 8. Shelves: 3/4 inch thermo fused melamine clad particleboard to match interior, PVC banded front edge to match interior color, adjustable on 32mm centers
 9. Drawer construction: Dowel construction with Sub-front, sides and back of 1/2 inch (12mm) PVC clad particleboard.
 10. Bottom: Nominal 1/2 inch with stiffeners, (1) at 24 inches, (2) at 36 inches and (3) at 48 inches white coated MDF board, inset into all four sides of drawer box and sealed with hot melt glue process around entire drawer bottom perimeter.
 11. Door and removable drawer front: 3/4 inch particleboard core with GP28 vertical surface grade high-pressure laminate, 3mm PVC banding.
 12. Fillers, knee space panels, scribes, and similar components: Shall be of the same material and finish as adjacent exposed surfaces, 3/4 inch thick particleboard.
 13. Pullboards: 1 inch thick particleboard with balanced laminated faces. Writing surface color to be Antique White. Front to be constructed the same as a drawer front as specified for cabinet face exterior.
 14. Suspension to be 3/4 extension, open roller, 75 lb. dynamic load, with hold open feature and epoxy coated.
 15. Knee space table frame: 3/4 inch particleboard; 3/4 inch hardwood if drawer cutouts are included.
- B. Wall, upper and tall cases:
1. Shall be manufactured with appropriate materials and joinery methods as specified for base units except as noted below.
 2. Tops: 3/4 inch thick, particleboard with banding on front edge.
 3. Bottoms:
 - a. Wall and upper case: 3/4 inch thick, particleboard with banding on front edge.
 - b. Tall case: 3/4 inch thick, 7-ply veneer core plywood with 3mm hardwood banding on front edge. Bottom plywood kick rail 3-3/4 inch high joined to cabinet sides.

4. Backs: 1/4 inch hardboard, thermo fused melamine interior, captured in top, bottom and side panels; mounting cleat at top.
5. Shelves: (Fixed shelves are 3/4 inch thick particleboard): 3/4 inch thick, thermo fused melamine clad particleboard to match interior, PVC banded on front edge to match interior color, adjustable on 32mm centers.
6. Solid door construction: 3/4 inch thick particleboard core with 3mm PVC banding on all four edges, balanced construction. For sliding doors, nylon roller suspension riding in overhead steel track with bottom retainer strip.
7. Framed glass doors: 3/4 inch particleboard routed to accept extruded vinyl glass retainer; laminate clad and edgebanded with 3mm PVC; capture 7/32 inch glass both sides in extruded vinyl molding. For sliding doors, nylon roller suspension riding in overhead steel track with bottom retainer strip.
8. Unframed sliding glass doors: 7/32 inch glass with edges ground, set in extruded aluminum shoe with integral pulls, nylon wheel assemblies and top and bottom extruded aluminum track. Provide rubber bumpers at fully opened and closed door position

PART 3 - EXECUTION

3.1 INSTALLATION - CABINETS

- A. Install all casework plumb, level, true and straight with no distortions. Cabinets at right angles to each other shall be erected at 90 degrees to each other unless otherwise indicated. Shim as required, using concealed shims. Where cabinets abut other finished work, scribe and apply filler strips, filler panels and fascias for accurate fit with fasteners concealed where practical and flush with cabinets alongside.
- B. Base Cabinets: Set cabinets straight, plumb and level. Adjust sub-tops within 1/16 inch of a single plane. Fasten each individual cabinet to wall, with stainless steel or chrome finished oval head screws with grommets spaced 24 inches o.c. Bolt continuous cabinets together. Secure individual cabinets with not less than two fasteners into floor, where they do not adjoin other cabinets.
 1. Where required, assemble units into one integral unit with joints flush, tight, and uniform.. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
- C. Wall Cabinets: Securely fasten to solid supporting material, not plaster, lath, or wall board. Anchor, adjust, and align wall cabinets as specified for base cabinets.
 1. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.
- D. Adjust casework and hardware so that doors and drawers operate smoothly without wrap or bind. Lubricate operating hardware as recommended by manufacturer.

3.2 TOLERANCES

- A. Maximum variation from true position 1/16 inch with a maximum of 1/32 inch offset from true alignment with adjoining surfaces intended to be flush.

3.3 ADJUSTING

- A. To whatever extent work was not completed at shop or prior to installation of casework, perform and complete the specified finishing of casework.
- B. Repair damaged and defective casework where possible eliminating defects functionally and visually.
 - 1. Where not possible to repair damaged or defective work, replace with matching new work.
 - 2. Adjust joinery for uniform appearance.
- C. Adjust doors and drawers for smooth and balanced movement, lubricate hardware for use.

3.4 CLEANING

- A. Clean Up: Remove all cartons, debris, sawdust, scraps, and leave spaces clean and all casework ready for Owner's use.
- B. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - Construction Waste Management and Disposal.

End of Section

Section 12 36 53
LABORATORY COUNTERTOPS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install epoxy resin laboratory countertops and integral sinks.
 - 1. Provide backsplash at all walls to heights indicated on Drawings.
 - a. Where wall cabinets are installed, backsplash to run from counter to underside of wall cabinets.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS: Special administrative and procedural requirements related to LEED VERSION 4 FOR BUILDING DESIGN AND CONSTRUCTION" (LEED v4 BD+C) certification goals of energy conservation and efficiency, indoor air quality, and natural resource efficiency.
- C. Section 06 40 00 - ARCHITECTURAL WOODWORK: Plastic laminated casework.
- D. Section 12 35 53 - LABORATORY CASEWORK.
- E. Division 22 – PLUMBING: All plumbing piping and connections, stainless steel sinks and related fixtures
- F. Division 23 – HEATING, VENTILATING AND AIR CONDITIONING.
- G. Division 26 – ELECTRICAL.

1.4 REFERENCES

- A. Referenced Standards: Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. The standards referenced herein are included to establish recognized minimum quality only. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern. Equivalent quality and testing standards will be acceptable, subject to their timely submission, review and acceptance by the Architect.
 - 1. ASTM D570 –Water Absorption of Plastics.

2. ASTM D635 –Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.1
3. ASTM D638 – Tensile Properties of Plastics.
4. ASTM D648 – Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
5. ASTM D651 – Glass-Bonded Mica Used as Electrical Insulation.
6. ASTM D695 – Compressive Properties of Rigid Plastics.
7. ASTM D785 – Rockwell Hardness of Plastics and Electrical Insulating Materials.
8. ASTM D790-Fluctural Properties of Un-reinforced and Reinforced Plastics and Electrical Insulating Materials.
9. ASTM E84-Surface Burning Characteristics of Building Materials.
10. ASTM G22-76(1996) – Determining Resistance of Plastics to Bacteria (a withdrawn standard).
11. National Sanitation Foundation (NSF/ANSI): Standard 51 – Food Equipment Materials.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
1. Literature: Manufacturer's product data sheets, specifications, performance data and physical properties.
 - a. Submit test data on chemical resistance of epoxy resin tops
 2. Manufacturer's instructions: Manufacturer's installation instructions indicating special procedures, and perimeter conditions requiring special attention.
 3. Certifications: Submit test data on chemical resistance of epoxy resin.
 4. Shop Drawings: Detailed shop drawings with field dimensions verified. Provide sufficient detail to show fabrication, installation, anchorage, and interface of the work of this Section with the work of adjacent trades.
 - b. Indicate location of seams in plastic laminate counter tops and in epoxy resin tops longer than 10 feet.
 5. Samples: Submit samples as requested by Architect including the following:
 - c. 6 by 6 inch samples of specified finishes including epoxy resin top materials.
 6. Fabrication Samples: Prior to start of work, fabricate a complete 24 inch wide base section with 1 drawer and 1 door, and epoxy work top. Sample shall show full construction of all joints in casework and sample joint in work top. Sample shall contain: door with specified hardware, drawer with slide and specified hardware, back and side panels. Samples not fully conforming to this specification shall be rejected by the Architect.
 - a. Deliver sample to Job site. Sample will be used for the purposes of establishing a quality control standard, which can be compared to the remaining Work.
 - b. Reviewed and accepted sample may be incorporated into the work.

- B. Submit manufacturer's warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS:

1.6 FIELD MEASUREMENTS

- A. Take field measurements before preparation of shop drawings and fabrication, where possible, to ensure proper fitting of Work.
 - 2. Verify field measurements and that laboratory countertops will fit through entryways, corridors and door openings.
 - 3. Wall-to-wall counter tops are to be installed with a maximum 1/4" gap total (1/8 inch on either end).
- B. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

1.7 SEQUENCING AND SCHEDULING

- A. Coordinate the work of this Section with the respective trades responsible for installing interfacing work, and ensure that the work performed hereunder is acceptable to such trades for the installation of their work.

1.8 PRODUCT HANDLING

- A. Delivery and Storage: Deliver materials under protective cover and store within dry enclosed space.
- B. Protection: Use all means necessary to protect materials of this Section during transition, before, during, and after installation and to protect installed work and materials of all other trades.
 - 4. Store under cover in a ventilated building not exposed to extreme temperature and humidity changes.
 - 5. Do not deliver casework to site until all concrete and masonry work is dry. Do not begin installation until veneer plaster has fully cured and is dry.
- C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no change in Contract Sum.

1.9 WARRANTY

- A. Provide manufacturer's two year warranty against all defects in material or workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on New England Laboratory, Woburn MA, representing: The Durcon Company, Inc., Plymouth MI.

- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. The Durcon Company, Inc., Plymouth MI.
 2. Epoxyn Products, Mountain Home, AR.
 3. Kewaunee Scientific Equipment Corporation, Statesville NC.
 4. Laboratory Tops, Inc., Taylor TX.

2.2 PERFORMANCE CRITERIA

- A. Minimum tested performance criteria:
1. Flexural Strength (tested per ASTM D790): 14,500 To 14,900 PSI.
 2. Modulus of Elasticity (tested per ASTM D790): 2,000,000 PSI.
 3. Compressive Strength (tested per ASTM D695): 33,500 To 38,100 PSI
 4. Tensile Strength (tested per ASTM D638/D651): 6,400+ PSI.
 5. Hardness, Rockwell "M" Scale (tested per ASTM D785): Values Of 105 To 113 Over 5 Samples - Average 109.
 6. Water Absorption (tested per ASTM D570): 0.008 To 0.02% After 24 Hours.
 7. Heat Distortion (tested per ASTM D648): 380 F (193 C).
 8. Flammability or Fire Resistance (tested per ASTM D635) did not ignite or self-extinguishing.
 9. Temperature Use Limit: 331 degrees F. (166 degrees C.).
 10. Fungai and Bacterial Growth Resistance (tested per ASTM G22): Approved.
 11. Food and Splash Zone (tested per NSF/ANSI Standard 51): Approved.
 12. Fire Resistance - Smoke Developed Index (tested per ASTM E84): 8.71 (In) /

2.3 COUNTERTOPS

- A. Countertops: 1 inch thick molded modified epoxy resin that has been especially compounded, oven cured and possess high resistance to mechanical and thermal shock.
1. Color: Special order, "Tan."
 2. Tops shall be a uniform mixture throughout their full thickness and not depend upon a surface coating for chemical or stain resistance.
 3. Integrally molded curbs: 4 inches high and 1 inch thick, and the junction between top and curb to be covered to a 5/8 inch radius. End curbs shall be provided at end of runs to maintain continuity of the integral curb.
 4. Countertops 10 feet or less in length shall be seamless. When length of top exceeds 10 feet, seams may be provided parallel to the short dimension (Locate as shown on reviewed and accepted shop drawings). Limit seams to absolute minimum number.

2.4 SINKS

- A. Integral Sinks:

1. Type EPS 1 (ADA) Durcon Model A55, having inside dimension of 25 inches by 15 inches by 4.8 inches deep, with corner drain..
2. Type EPS-2 (Standard) Durcon Model D54, having inside dimensions of 25 inches by 15 inches and 8 inches deep with corner drain.

2.5 ACCESSORIES

- A. Sealant, for joints between countertops and dissimilar materials: Joint Sealer Type 'SM' as specified in Section 07 92 00 - JOINT SEALANTS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
 1. Carefully examine the installed work of others and verify that such work is complete to the point where this installation may properly commence.
 2. Verify adequacy of backing and support framing: Coordinate with the General Contractor/Construction Manager to verify that required backing and reinforcements are in place, secure, and accurately located and that project is ready for the installation of the laboratory countertops.
- B. Proceed with work when conditions permit Work to be installed in complete accordance with the original design, accepted submittals, and the manufacturer's written instructions.
- C. In the event of discrepancy, immediately notify the Architect in writing. Do not proceed with the installation in areas of discrepancy until issues have been resolved
- D. Beginning of installation means acceptance of project conditions.

3.2 INSTALLATION

- A. Counter top lengths shall be fabricated as specified and indicated on the drawings with ends abutting tightly in a hairline joints, single true plane, smooth and level with no raised edges at the joints with supports place to prevent deflection. All joints are to be sealed with corrosion resistant sealants.
- B. Make field jointing in same manner as factory jointing using dowels, splines, adhesives, and fasteners recommended by manufacturer. Locate field joints as shown on accepted submittal drawings. Joints shall be factory prepared requiring no job site processing of top and edge surfaces.
- C. Tops shall be anchored to base cabinets. Secure tops to cabinets/supports with concealed "Z" type angles or equal fastening devices spaced no more that 24 inches on center, with one located within 6 inches of front and back edge. Tighten according to manufacturer's written instructions to exert a uniform heavy pressure at joints. Countersink exposed heads approximately 1/8 inch and plug flush with material equal in chemical resistant, color, harshness and texture to adjoining surface. Where work surface in intended to be moveable use a clamping device that is removable. Counter tops to be installed with a maximum 1/8" gap. Secure

epoxy countertops to cabinets with epoxy cement, applied at each corner and along perimeter edges at not more than 48 inches on center.

- D. Provide holes and cutouts as required for equipment and service fittings and fixtures. Verify size of opening with actual size of item to be used, prior to making openings. Form inside corners to a radius of not less than 1/8". After cutting, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a chemical resistant sealer recommended by the manufacturer.
- E. Provide scribe moldings for closures at junctures of countertop, curb and splash with walls as recommended by manufacturer for materials involved. Match materials and finish to adjacent laboratory casework. Use chemical-resistant, permanently elastic sealing compound where recommended by manufacturer.
- F. Carefully dress joints smooth, remove surface scratches and clean entire surface.

3.3 CLEANING

- A. Repair or remove and replace defective, damaged or soiled work to match original factory finish.
- B. Clean finished surfaces, including wiping of drawers and cabinet shelves, touch up as required.
- C. Clean counter tops leaving tops free of grease and streaks. Use no wax or oils.

3.4 PROTECTION

- A. Protect against soiling and deterioration during remainder of construction period.
- B. Protect counter tops and ledges for the remainder of the construction period with 1/4" corrugated cardboard or equal completely covering the top and securely taped to edges. Mark cardboard in large lettering "No Standing".

End of Section

Section 12 48 13
ENTRANCE GRILLES AND FRAMES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install the following:
 - 1. Recessed floor grilles and frames at entrances.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. ASTM E 648 - Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
 - 2. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 - 3. All applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications, performance data, physical properties, for each item furnished hereunder, including inserts, accessories, adhesives, and leveling materials. Include manufacturer's application methods or installation instructions for each item furnished hereunder.
 - 2. Manufacturer's warranties: Include coverage of materials and installation and resultant damage from failure of installation.

3. Manufacturer's certificate: Provide certificate stating that the floor grille, and other related materials to be supplied hereunder meet all requirements specified herein.
4. Selection samples: Sample swatches containing manufacturer's full color and blend range.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Maintain a temperature of at least 60 degrees Fahrenheit, with a relative humidity of between 15 and 60 percent, for a period of 48 hours before, during, and after installation.
- B. Store all mat materials under cover in dry, well-ventilated spaces as soon as delivered. Protect floor mating from damage, dirt, stain, moisture, and mildew.

1.7 ENVIRONMENTAL CONDITIONS

- A. Store materials for 3 days prior to installation in area of installation to achieve temperature and humidity stability.
- B. Maintain minimum 70 degrees Fahrenheit ambient temperature 3 days prior to, during, and 24 hours after installation of materials.

1.8 SEQUENCING AND SCHEDULING

- A. Sequence work to ensure floor grille is not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated and work overhead is completed.

1.9 WARRANTY

- A. Provide 10 year warranty under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.

1.10 EXTRA MATERIALS

- A. Upon completion of the Work of this Section, deliver to the Owner extra materials for future repairs and maintenance, an amount equal to 25 percent of inserts for each color, pattern installed.
- B. Clearly label and package extra materials securely to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Mats Inc., Stoughton MA., Product: "UltraTrak".
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 1. Mats Inc., Stoughton MA.

2. Nystrom, Inc., Minneapolis, MN.
3. Balco Inc., Wichita KS.
4. Construction Specialties, Inc., Muncy, PA.

2.02 PERFORMANCE REQUIREMENTS:

- A. ASTM C1028 Static Coefficient of Friction: 0.65 Wet
- B. ASTM B117 Product Corrosion to Salt: Product withstands 1000 hours of salt fog without any noticeable changes.

2.03 MATERIALS

- A. Foot grille fabricated to sizes indicated on the Drawings with mechanically fastened rails.
 1. Construction: Bolt-thru design with individual aluminum spacers.
 - a. Swedge, welded and key lock fastening of rails is not allowed.
 2. Material: Aluminum Alloy type 6061-T6. Soft Aluminum alloy (such as 6063-T52) is not allowed
 3. Drying Insert: Drying inserts to be Nylon material with 5% post-consumer recycled content.
 4. Blades: T-Shaped blades. Spacing between blades not to exceed 3/16 inch.
 5. Thickness: 1 inch.
 6. Panels: Foot Grille to be supplied in panels not to exceed 48" x 42". One Piece design not allowed. All grille panels to be supplied with individual, pre-fabricated, factory-assembled frames.
 - B. Recessed Frame: Frames shall be a "Z" shape equal to model "TT" by Mats Inc., anchoring the foot grille structure into concrete. All aluminum frames shall be pre-assembled at factory incorporating welded construction for all joints with mitred corners. Multiple grille sections shall incorporate an invisible section divider integrated and welded within the frame.
- A. Accessories:
1. Recessed pan: 20 gauge aluminum.
 2. Accessories: Stainless steel hinges. Galvanized Steel keyless-lock downs attached to each grid section.

2.2 FINISHES

- A. Finish coatings for aluminum to conform to Finish Designation system: AAMA 607.1.
 1. Exposed Aluminum Surfaces: (AA designation M12C22A41) Architectural Class I anodic coating, 0.7 mil thickness or greater, prepared with a mechanical M12, chemical C22 pre-treatment, clear anodized in color.

2.3 ACCESSORIES

- A. Filler for patching, smoothing and leveling substrate: Portland cement-based latex underlayment acceptable to flooring manufacturer, equal to the following:

1. Ardex, Inc., products "Feather Flash" and "Ardex SD-P".
2. Quikrete Companies, product "Fast-Set Underlayment 1248".
3. Silpro Masonry Systems Inc., product "Masco Latex Cement"

2.4 FABRICATION

- A. Fabricate frame to be truly straight, level and square. Provide frame pieces in longest available lengths to minimize joints. Space unavoidable joints evenly about centerline of mat and spline butt-joints with connecting pins. Form corners with tightly mitered joints or use prefabricated jointless corners.
- B. Provide frames and mats to sizes, shapes, and profiles indicated on approved shop drawings. Provide one-piece mats except where size exceeds manufacturer's recommended limit for easy removal and cleaning. Where more than one-piece mats are used, locate seams away from main traffic pattern.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Request correction of defects in receiving surfaces which are not correctable by the methods specified herein. Do not commence work until such defects are entirely corrected. Beginning of installation means acceptance of existing substrate and site conditions.

3.2 PREPARATION

- A. Thoroughly sweep and vacuum all surfaces and remove all foreign matter.

3.3 INSTALLATION

- A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all units firmly into position, square, plumb, straight, and true.
- B. Cast the edge extrusion into the concrete slab.
- C. Set the grid units in place, shimming with vinyl to provide stability on the Drain Pan.

3.4 PROTECTION

- A. Prohibit traffic from floor mat areas for 24 hours after installation.

End of Section

Section 12 61 00
FIXED AUDIENCE SEATING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. The work of this Section consists of furnishing and installing fixed and mobile audience seating where shown on the Drawings, as specified herein, for a complete and proper installation.

1.3 RELATED REQUIREMENTS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL: Procedural and administrative requirements for construction and demolition recycling.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE
- C. Section 09 68 00 - CARPETING.
- D. Division 26 - ELECTRICAL: Electrical work related to items in this Section.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets and specifications, for each product installed and furnished hereunder indicating configurations, sizes, materials, finishes, locations, utility connections and locations. Include information on accessories and options.
 - 2. Certification: Manufacturer's written certification stating that seating to be furnished hereunder, meet or exceed the requirements specified under this Section and the fire resistive requirements of California Technical Bulletin No. 133 for the indicated requirements have been met.

3. Shop drawings:
 - a. Large scale plans, completely dimensioned showing seating layout. Vary lateral sizes of chair backs, with standards in each row spaced laterally so that the end standards shall be in alignment from first to last row whether aisles are of constant or converging width. Spacing from chairs to walls shall be nominally 1-1/2 inches, and in no circumstances exceed 4 inches. Back to back spacing of chairs shall be not less than 33 inches. Subcontractor assumes complete responsibility for accuracy of layout, and coordination with other trades. As a minimum, indicate the following:
 - 1) All chair sizes, chair pedestals and aisle widths. Not more than 15 percent of chairs may be 19 inch width.
 - 2) Wheelchair locations and handicap seating locations
 - 3) Aisle lighting locations.
 - 4) Aisle and seat numbering scheme.
 - b. Large scale details of chair construction, bases, pedestals, and all other components of the seats.
 - 1) Indicate all materials, sizes, gauges, thickness, and weights.
 - 2) Provide complete setting diagrams including anchorage details.
 - 3) Indicate relationship to electrical stub-outs for aisle lighting.
4. Verification samples:
 - a. 36 by 36 inch (1 square yard) samples of upholstery for each color selected by Architect.
 - b. If requested by Architect, one complete chair demonstrating all selected finishes and specified components. Approved sample will be returned to Contractor and may be installed in project.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver seating units materials to the project until finish work has been completed and dry, including finish woodwork, ceiling materials, wall finishes and painting.
- C. Protect seats from damage due to moisture, direct sunlight, excessive temperatures, surface contamination and damage from construction operations and other causes.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before and during installation of chairs; maintain same temperature until Owner's Final Acceptance.
- B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before and during installation of chairs: maintain same relative humidity until Owner's Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design (Specified Manufacturer): To establish a standard of quality, design and function desired, Drawings and specifications have been based on KI Furniture and Seating (KI), having the following characteristics:
1. Seating Style: KI "Lancaster" Series.
 2. Wood species: KI "Standard Wood" series, color "Kensington Maple on Maple".
 3. Laminate: KI "Seating Laminates" series, color: "Kensington Maple".
 4. Includes optional wood armcap, finished in "Kensington Maple".
 5. Includes decorative end panel in laminate or wood.
 6. Includes optional row and seat markers: Silver color, aluminum.
 7. No tablet arms.
 8. No cupholders.
- B. Acceptable manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
1. KI Furniture and Seating, Green Bay, WI.
 2. Sedia Systems, Chicago IL.
 3. American Seating, Grand Rapids, MI.

2.2 REGULATORY REQUIREMENTS

- A. Upholstered seating provided under this Section 126100 shall be in compliance with Commonwealth of Massachusetts Fire Prevention Code 527 CMR 12.6.1.3 and is required to meet one of the following:
1. The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260, Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture, or with ASTM E 1353, Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture.
 2. Mocked-up composites of the upholstered furniture shall have a char length not exceeding 1 1/2 in. when tested in accordance with NFPA 261, Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes, or with ASTM E 1352, Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies.[101:10.3.2.1].
 3. The requirements of California Technical Bulletin 117-2013, Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture
 4. Upholstered seating provided under this Section 12 61 00 shall have been tested in accordance with California Technical Bulletin No. 133 and certified as passing such tests. Every chair shall be labeled with certification label.

- B. Send copy of certificate of compliance to municipal authority having jurisdiction.

2.3 MATERIALS - GENERAL

- A. Steel standards and back wings: All steel shall have smooth surfaces and be of sufficient gauge thickness and designed to withstand strains of normal use and abuse.
- B. Padding material: Seat and back padding material shall be of new (prime manufacture) polyurethane foam, and include open cell foam padding.. Padding material shall comply with the flammability requirements outlined in California Technical Information Bulletin No. 117, Resilient Cellular Materials, Section A and D, dated February 1975, when tested in accordance with Federal Test Method Standard 191, Method 5903.2.
 - 1. Padding shall be securely adhered to plywood inner shell.
 - 2. Thickness: 2 inches.
- C. Wood: Plywood, exposed or concealed, hardwood, made with adhesive containing no added urea formaldehyde (NAUF).
- D. Upholstery Fabric: Unbacked breathable fabric, in compliance with class 1 flammability requirements of US Department of Commerce Commercial Standard 191 per California Technical Bulletin No. 117.
 - 1. Treat fabric for fire retardance to comply with Massachusetts Fire Code Regulation FPR 20 and California Technical Fire Safety Bulletin 117 Section E, NFPA 701.
 - 2. Fabric color and pattern shall as selected by Architect, acceptable manufacturers include the following or approved equal.
 - a. KI Furniture and Seating, Green Bay, WI.
 - b. CF Stinson, Rochester Hills, MI.
 - c. Mayer Fabrics (Mayer-Paetz Inc.), Indianapolis, IN.
- E. Injection molded plastic: one-piece high-impact, linear polyethylene with built-in ultraviolet light inhibitors to retard fading. Plastic shall have a burn rate of 1 inch per minute when tested in accordance with ASTM D635 or the Department of Transportation Motor Vehicle Safety Standard No. 302. Color shall be selected from manufacturer's standard color range.

2.4 SEATING

- A. General: Floor attached type chairs, 19 to 23 inch widths, consisting of an attached inner upholstered back and hinged fully upholstered seat which automatically returns to an upright three-quarter fold position.
 - 1. Not more than 15 percent of all seating may be 19-inch width. No 19-inch width seats shall be placed adjacent to another 19-inch width seat. 19-inch width seats shall be randomly distributed throughout the auditorium and lecture halls in the widest possible dispersion pattern.
 - 2. Provide armless seats in compliance with accessibility requirements, where indicated on the Drawings.
 - 3. Provide transfer seats in compliance with accessibility requirements.

4. Provide accessible locations as indicated.
 5. Provide ADA Removable Units where indicated on Drawings with letter "R."
 6. Provide KI's "Versa Conference Chair" square back seating style (VCSLU) movable chair, with arms, four legs, ply/nylon glides, in matching frame and upholstery colors, indicated on the Drawings with letter "M"
- B. Standards: Floor mounted formed steel.
1. Standards: The standards shall be pedestal design made by a rectangular tube, nominally 1 by 3 inches, with heavy gauge steel. A reinforced bracket for seat pan attachment shall be integrated into the standard which has an inlay at midpoint for resistance upon force.
 2. Aisle Standards-Rectangular-3/4 size design: The aisle standards shall be fabricated in the same manner as the center standards with a formed panel of 16 gauge steel welded to the column to accept a decorator panel:
 - a. Rectangular shaped end standard shall be painted with epoxy powder finish.
- C. Chair backs: Manufacturer's optional wood back panel with 3/8 inch thick veneer core and 1/16 inch thick maple veneer face, attached to 7/16 inch thick molded plywood inner structure bonded with 2 inches of 1.8 pcf density urethane foam.
- D. Seat assembly: Self-lifting seat, padded and upholstered with one-piece injection molded outer panel and hardwood inner upholstery panel.
1. Counter Balance: The seat pan shall rotate on two solid steel rods with lifetime lubricated nylon shoulder bushings. The rear area of the pan shall be weighted to create a counterbalance that allows the seat to return to 90 degree vertical position by means of gravity.
 2. Provide seat numbers and locate them on the front edge of the seat pan.
- E. Armrests: Provide manufacturer's optional wood armcap, nominal 2-5/16 inches wide by 11-1/2 inches long and attached to the armcap support with four concealed screws.
- F. Aisle Lights (locate as indicated on approved shop drawings): UL listed, pre-wired and finished complete with utility box, light socket, LED lamp and detachable lens plate, located under arms.
1. Provide 1 light per riser/step to be on side of seating areas coordinate with Division 26 – Electrical.
- G. Custom made number and letter plates: 5/8 by 1-5/8 inch brushed aluminum finished plates with Helvetica Medium letter and numerals.
1. Attach plates with escutcheon pins with matching finish.

2.5 FINISHES

- A. All exposed metal, including bolted connections and anchoring parts shall have a baked enamel finish in warm gray color.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install chairs in locations indicated on reviewed and accepted shop drawings in accordance with manufacturers written instructions.
 - 1. Check all dimensions against shop drawings and make necessary adjustments for discrepancies in layout.

3.3 TOLERANCES

- A. Maximum variation from plumb or level: 1/8inch.

3.4 PROTECTION

- A. Protect chairs with temporary plastic covers under provisions of Section 01 50 00 - Temporary Facilities and Controls.

End of Section

Section 12 66 13
TELESCOPING BLEACHERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section.

1.2 SUMMARY

- A. Furnish and install telescoping, motorized, gymnasium bleacher seating, including all anchorage required.

1.3 RELATED SECTIONS

- A. Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT: Procedural and administrative requirements for construction recycling.
- B. Section 03 30 00 - CAST-IN-PLACE CONCRETE
- C. Section 09 64 66 - WOOD ATHLETIC FLOORING
- D. Division 26 – ELECTRICAL: Power supply.

1.4 REFERENCES

- A. Comply with applicable requirements of the following standards and those others referenced in this Section, under the provisions of Section 01 42 00 - REFERENCES. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1. Comply with all applicable federal, state and municipal codes, laws and regulations regarding flammability and smoke generation of interior finishes.

1.5 SUBMITTALS

- A. Submit the following under provisions of Section 01 33 00 - SUBMITTAL PROCEDURES:
 - 1. Literature: Manufacturer's product data sheets, specifications and installation instructions.
 - 2. Certificates: Wood products lacking acceptable documentation for the following will be rejected and their removal required.
 - 3. Shop drawings: Large scale plans showing bleacher layout. Include painted on graphics.
 - 4. Samples: Minimum 2 square foot sample of painted graphics.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Do not deliver items to the site, until all specified submittals have been submitted to, and approved by, the Architect.
- B. Do not deliver seating units materials to the project until finish work has been completed and dry, including finish woodwork, ceiling materials, wall finishes and painting. Coordinate installation of bleachers with Section 09 64 66 - WOOD ATHLETIC FLOORING. Take all precautions necessary to protect flooring.
- C. Protect bleacher components from damage due to moisture, excessive temperatures and damage from construction operations and other causes.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperature above 55 degrees Fahrenheit for 5 calendar days before and during installation of bleachers; maintain same temperature until Owner's Final Acceptance.
- B. Maintain a relative humidity between 25 and 55 percent for a minimum period of 5 calendar days before and during installation of bleachers: maintain same relative humidity until Owner's Final Acceptance.

1.8 WARRANTIES

- A. General: Submit warranties under provisions of Section 01 78 00 - CLOSEOUT SUBMITTALS.
- B. This is a phased occupied project; refer to Division 1 specifications for more details. The parts and labor warranty period for all material and equipment installed under this contract shall commence upon substantial completion of the final phase of the building project scheduled to be in August of 2016. Equipment installed under previous phases must be maintained and serviced by the contractor throughout the project up until owner acceptance or Substantial Completion, whichever comes last. Service intervals shall be as recommended by the various equipment manufacturers with all maintenance materials included.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Specified Manufacturer: To establish a standard of quality, design and function desired, Drawings and specifications have been based on Hussey Seating Company, North Berwick ME.
- B. Acceptable Manufacturers: Subject to compliance with the requirements specified herein, manufacturers offering products which may be incorporated in the work include the following, or approved equal:
 - 1. Hussey Seating Company, North Berwick, ME.
 - 2. Folding Bleachers Company, Effingham, IL
 - 3. Interkal Inc., Kalamazoo, MI.

2.2 SYSTEM DESIGN CRITERIA

- A. Gymnasium seat assembly, shall be designed to support and resist, in addition to it's own weight, the following forces:
 - 1. Live load of 120 lbs per linear foot [162.69 N/m] on seats and decking.
 - 2. Uniformly distributed live load of not less than 100 lbs per sq. ft. [135.58N/m] of gross horizontal projection.
 - 3. Parallel sway load of 24 lbs. [32.53 N/m] per linear foot of row combined with (b.) above.
 - 4. Perpendicular sway load of 10 lbs. [13.56 N - m] per linear foot of row combined with (b.) above.
- B. Hand Railings, Posts and Supports, shall be engineered to withstand the following forces applied separately:
 - 1. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction.
 - 2. Uniform load of 50 lbs. per foot [.344 N/mm²] applied in any direction.
- C. Guard Railings, Post and Supports, (Shall be engineered to withstand the following forces applied separately):
 - 1. Concentrated load of 200 lbs. [90.72 kg] applied at any point and in any direction along top rail.
 - 2. Uniform load of 50 lbs. per foot [.344 N/mm²] applied horizontally at top rail and a simultaneous uniform load of 100 lbs. per foot [.689 N/mm²] applied vertically downward.
- D. Member Sizes and Connections: Design criteria (current edition) of the following shall be The basis for calculation of member sizes and connections:
 - 1. AISC: Manual of Steel Construction.
 - 2. AISI: Specification for Design of Cold Formed Steel Structural Members.
 - 3. AA: Specification for Aluminum Structures.
 - 4. NFOPA: National Design Guide For Wood Construction.

2.3 SUSTAINABILITY CHARACTERISTICS

- A. Comply with sustainability characteristics for each "Sustainability Focus Material" in accordance with Section 018113 Appendix A and Appendix B.

2.4 MATERIALS

- A. Lumber: ANSI/Voluntary Product 20, B & B southern pine.
- B. Plywood: ANSI/Voluntary Product PS1, APA A-C exterior grade.
- C. Structural steel shapes, plates and bars: ASTM A 36.
- D. Uncoated steel strip (non-structural components):
- E. ASTM A569, commercial quality, hot-rolled strip.

- F. Uncoated steel strip (structural components): ASTM A570 Grade 33, 40, 45, or 50, Structural Quality, Hot-Rolled Strip.
- G. Uncoated Steel Strip (Structural Components): ASTM A607 Grade 45 or 50, high-strength, low alloy, hot-rolled strip.
- H. Galvanized steel strip: ASTM A653 Grade 40, zinc coated by the hot-dip process, structural quality.
- I. Structural tubing: ASTM A500 Grade B, cold-formed.
- J. Polyethylene Plastic: ASTM D 1248, Type III, Class B; molded, color-pigmented, textured, impact-resistant, structural formulation; in color as selected by Architect from manufacturer's standard colors, unless otherwise indicated.
- K. Fasteners: Vibration-proof, of size and material standard with manufacturer.

2.5 BLEACHERS

- A. General: Wall attached bleachers with continuous rows, and railings at each end. Units with 26 inch row spacing seat spacing as indicated on the Drawings, with aisles spaced as indicated on Drawings. Seat rows shall have a rise not less than 9-1/2 inches and not more than 10-1/2 inches.
 - 1. Net capacity: Single bank, 10 rows, for total of 286 persons.
- B. Understructure fabrication:
 - 1. Frame System:
 - a. Wheels: Not less than 5 inches [127] diameter by 1-1/4 inches [32] with non-marring soft rubber face with molded-in sintered iron oil-impregnated bushings to fit 3/8 inch [10] diameter axles secured with E-type snap rings.
 - b. Lower Track: Continuous positive interglide system using an integral, continuous, anti-drift feature and through-bolted guide at front. Manual sections shall contain a low profile lock equal to Hussey Posi-Lock LX to lock each row in open position and allow unlocking automatically. Provide adjustable stops to allow field adjustment of row spacings.'
 - c. Slant Columns: High tensile steel, tubular shape.
 - d. Sway Bracing: High tensile steel members through-bolted to columns.
 - e. Deck Stabilizer: High tensile steel member through-bolted to nose and riser at three locations per section. Interlocks with adjacent stabilizer on upper tier using low-friction nylon roller incorporates multiple stops to allow field adjustment of row spacings.
 - f. Deck Support: Captures front and rear edge of decking at rear edge of nose beam and lower edge of riser beam for entire length of section.
 - 2. Deck System:
 - a. Section Lengths: Each bank shall contain sections not to exceed 25'-6" in length with a minimum of two supporting frames per row, each section.
 - b. Nose beam and rear riser beam: Nose beam shall be continuously roll-formed closed tubular shape of ASTM A653 grade 40, Riser beam shall

- be continuously roll-formed of ASTM A653 grade 40. Nose and Riser beam shall be designed with no steel edges exposed to spectator after product assembly.
- c. Attachment: Through-Bolted fore/aft to deck stabilizers, and frame cantilevers.
 - d. Decking: 5/8 inch [16], AC grade clear-top-coated tongue and groove Southern Yellow Pine; or BC grade polyethylene-top-coated tongue and groove Douglas Fir plywood; both of interior type with exterior glue, 5-ply, all plies with plugged crossbands, produced in accordance with National Bureau of Standards PS-1-97. Plywood shall be cut and installed with top, center and bottom ply grain-oriented from front of deck to rear of deck (nose beam to riser beam). Adjacent pieces shall be locked together with tongue and groove joint from front to rear of deck. Longest unsupported span: 21-1/2 inches [546].
 - e. Deck end overhang: Not to exceed frame support by more than 5'-7" [1702].
3. Seating Fabrication: Equal to Hussey Plastic Seat System –Courtside Collection - XCS12 (12 inch):
- a. Contoured Seat Modules: 18 inches [457] long assembled, gas assisted injection-molded, high density, 100 percent recyclable HDPE (high density polyethylene) modules in monochromatic colors, dual textured scuff resistant wide seat surface with 1/2 inch [13] minimum interlock on seat and face. Unit shall be structurally tested to 600 lbs occupant load.

2.6 MOTORIZED SEATING

- A. Integral Power: Furnish and install an integral automatic electro-mechanical propulsion system, to open and close telescopic seating. System shall be Underwriters Laboratories, Inc. (UL) approved and listed.
1. Operation shall be with a removable pendant control unit which plugs into seating bank for operator management of stop, star, forward, and reverse control of the power operation.
 2. Each unit shall consist of output shaft gear reducer with 6 inch diameter by 4 inch shall be fitted with induction motors, which will provide an average operating speed of 38 feet per minute. Propulsion system shall be spring loaded adjustable for floor variations and installed under the first moving row.
 3. Limit Switchers: Furnish and install both open and closed limit switches for the integral power system. The limit switchers will automatically stop integral power operation when seating has reached the fully extended or closed position.
 - a. Power operation shall utilize a combination of contactors and limit switches to ensure that the wire is not energized except during keyed operation. Straight wired electric system is not allowed.
 4. Electrical: Seating Manufacturer shall provide all wiring within seating bank including pendant control.
 - a. Each unit shall be power operated by a 1/2 horsepower, 1725 RPM, 115 Volts, 60 Hz., single phase 1.25 service factor motor. This motor draws a service factor current of 11 amperes. Power service to run this motor

is 120 volt (20 amp) single phase service. The service amperage will be 20-30 or 40 depending upon the number of motors to be operated. Motors, housing, and wiring shall be installed and grounded in complete accord with the National Electric Code.

- b. The electrical contractor shall provide power source with no greater than 4 percent voltage drop at the seating junction box. The electrical contractor shall perform all wiring connections in junction box that is attached or part of the building.

2.7 ACCESSORIES

- A. Master Key/Hinged Skirt Boards: All skirtboards shall be hinged and each section shall have key locks with all locks keyed alike.
- B. Handicap Cutouts: Provide first tier handicap cutouts per requirements of Americans with Disability Act (ADA) located as indicated. Provide rigid 38 inches high above deck, front rails with tubular supports attached to the rear of each handicap seating area. Provide a full width front closure panel at handicap cutout, extending from underside of second tier to within 1-½ inches of finished floor.
- C. Front Panel: Provide elevated seating equipment with full width front closure panels as required. Panels shall extend vertically from underside of front row to within 1-½ inches of floor. Paneling to be 5/8 inch Southern pine plywood attached to a steel framework.
- D. End Panel: Provide closure and panels for stack position at each exposed bank ends. Panels shall be manufacturer's standard vinyl end panels.
- E. Rear Panel: Provide required seating units with full width rear closure panels. Panels shall extend vertically full height up to 8'-0' high to within 1-1/2 inches of floor. Paneling to be 5/8 inch Southern pine plywood attached to a steel framework.
- F. Extended Rear Panel: Provide required seating units with full width extended rear closure panels. Extended rear panels shall extend vertically up to 42 inches above top of seat height and to within 1-1/2 inches of floor. Paneling to be 5/8" Southern Pine plywood attached to a steel framework.
- G. Front Rail: Provide 38 inches high above deck, demountable steel rails with tubular supports and intermediate members. Rails to be located at each required seating locations.
- H. Ready Rail End Rails: Provide steel 42 inches high above seat, end rail with tubular supports and intermediate members designed with 4 inches sphere passage requirements.
- I. Top Seat Flush Filler: Provide at top seat level a flush filler board mounted between top seat and rear wall. Flush filler board shall be constructed of 4/4" nominal thickness Southern pine Grade B & B clear urethane finished.
- J. Rear Bench Seats: Provide seating units not wall attached with a full width 1 foot 5 inches high rear seat. Rear seats shall extend 1 foot 3 inches out from rear of stands and shall be of same material and finish as seating.

- K. Manual Ball Fender: Include on classic wood gym seats units six (6) rows or more of single stack configuration, top row foot well closure to prevent lodging of basketballs.

2.8 SHOP FINISHES

- A. Understructure: For rust resistance, steel understructure shall be finished on all surfaces with white "Dura-Coat enamel. Understructure finish shall contain a silicone additive to improve scratch resistance of finish. Tubular steel that cannot be painted inside is unacceptable.
- B. Wear Surfaces: Surface subject to normal wear by spectators shall have a finish that does not wear to show different color underneath:
 - 1. Steel nosing and rear risers shall be pregalvanized with a minimum spangle of G-60 zinc plating. Painted nosings or risers are unacceptable.
 - 2. Decking shall have surfaces to receive a sealer coat with use surfaces to receive which gloss clear urethane finish. Painted decks are unacceptable.
 - 3. Classic wood seats and fascia shall be triple sanded and receive a sealer coat with use surfaces to receive high gloss clear urethane finish.
- C. Railings: Steel railings shall be finished with powder coated semi-gloss black enamel.
- D. Color: all exposed metal shall be finished in White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspect all surfaces and verify that they are in proper condition to receive the work of this Section.
- B. Beginning of installation means acceptance of existing project conditions.

3.2 INSTALLATION

- A. Install bleachers in locations indicated on reviewed and accepted shop drawings in accordance with manufacturers written instructions.

3.3 CLEANING

- A. Waste Management: Recycle or dispose of off-site waste materials and trash at intervals approved by the Owner and in compliance with waste management procedures specified in Section 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.4 PROTECTION

- A. Protect bleachers from damage until Substantial Completion of Contract under provisions of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

End of Section

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Section 14 21 00
ELEVATORS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.
- B. Work of this Section requires Filed Sub-bids and is governed by the provisions of the Massachusetts General Laws (MGL), Public Bidding Law - Chapter 149, Sections 44A to 44J inclusive, as amended, and applicable Sections of the MGL, Public Contract Law - Chapter 30.
- C. The work to be completed by the Filed Subcontractor for the work of this Section is shown on the following listed Drawings, not just those pertaining particularly to this Sub-Trade, unless specifically called out otherwise, regardless of where among the Drawings it appears:
 - 1. Architectural Drawings: VT01
- D. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the Work of this Filed Subcontract.
- E. Sub-Bids for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
 - 1. The following shall appear on the upper left-hand corner of the envelope:

NAME OF SUB-BIDDER: _____
SUB-BID FOR TRADE: ELEVATORS
 - 2. Each Sub-Bid submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit.
- F. Sub Sub-Bid Requirements: NONE REQUIRED UNDER THIS SECTION.

1.2 DESCRIPTION

- A. Work Included: The extent of the work is indicated on the drawings and specified under these contract documents.
- B. Work of this Section includes labor, materials, tools, equipment, appliances and services required to manufacture, deliver and install the units complete as shown on the drawings, as specified herein, and/or as required by job conditions.
- C. The work and/or requirements specified in all sections is described in singular with the understanding that identical work shall be performed on all units or associated systems unless otherwise specified herein.
- D. The work shall include, but is not limited to the following:
 - 1. Installation of one (1) 4,500 lb. service shaped machine room less traction (MRL) elevator operating at a speed of 200 fpm and serving four (4) landings.

E. Related Sections

1. Division 01: Protecting hoistway during installation of equipment, LEED Reporting Form, Construction Waste Management, Sustainable Design Requirements, Indoor Air Quality Management, Volatile Organic Compound Limits.
2. Division 03: Cutting and patching.
3. Division 03: Concrete pits and slabs.
4. Section 03 60 00: Grouting under hoistway door sills.
5. Section 05 12 00: Structural steel hoistway frame, hoist beam in overhead.
6. Section 05 50 00: Access Ladders, smoke hole grating, railing, intermediate support members, sump pit covers.
7. Section 05 70 00: Interior Ornamental Metals.
8. Division 07: Elevator pit waterproofing.
9. Section 08 80 00: Interior Glass and Glazing.
10. Section 09 20 00: Shaft and control room walls.
11. Section 09 60 00: Finished flooring.
12. Division 23: Ventilation of hoistway and fire extinguisher in the control room.
13. Division 26: Power feeders to starter panels through fused main line switches
14. Division 26: Branch circuits through fused disconnects for car lights.
15. Division 26: Lights and GFI receptacles in control room, overhead, and pit.
16. Division 26: Signal wiring to initiate emergency power operation.
17. Division 26: Signal wiring from smoke detectors to a junction box in the machine room.
18. Division 26: Empty conduit runs for wiring required to monitor elevators from a central location.
19. Division 27: Telephone communication wiring to a junction box in the control room for each elevator.
20. Division 27: Card reader and CCTV Systems, device and their interface with the elevator system.
21. Division 27: Telephone communications wiring terminated in a junction box located next to the controller.
22. Division 27: Ethernet port in the control room

F. Abbreviations and Symbols

1. The following abbreviations, Associations, Institutions, and Societies may appear in the Project Manual or Contract Documents:

AHJ	Authority Having Jurisdiction
AIA	American Institute of Architects
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Agency
OSHA	Occupational Safety and Health Act

G. Codes and Ordinances / Regulatory Agencies

1. Work specified by the Contract Documents shall be performed in compliance with applicable Federal, State, and municipal codes and ordinances in effect at the time of Contract execution. Regulations of the Authority Having Jurisdiction shall be fulfilled by the Contractor and Subcontractors. The entire installation, when completed, shall conform with all applicable regulations set forth in the latest editions of:
 - a. Local and/or State laws applicable for logistical area of project work.
 - b. Building Code applicable to the AHJ.
 - c. Elevator Code applicable to the AHJ.
 - d. Massachusetts 524, 780, and 521 CMR.
 - e. Safety Code for Elevators and Escalators, ASME A17.1 and all supplements as modified and adopted by the AHJ.
 - f. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2.
 - g. Guide for emergency evacuation of passengers from elevators, ASME A17.4.
 - h. National Electrical Code (ANSI/NFPA 70).
 - i. American with Disabilities Act - Accessibility Guidelines for Building and Facilities and/or A117.1 Accessibility as may be applicable to the AHJ.
 - j. ASME A17.5/CSA-B44.1 - Elevator and escalator electrical equipment.
2. The Contractor shall advise the Owner's Representative of pending code changes that could be applicable to this project and provide quotations for compliance with related costs.

H. Reference Standards

1. AISC - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
2. ANSI/AWS D1.1 - Structural Welding Code, Steel.
3. ANSI/NFPA 80 - Fire Doors and Windows.
4. ANSI/UL 10B - Fire Tests of Door Assemblies.
5. ANSI/IEEE - 519-Latest Edition
6. ANSI/IEEE - Guide for Surge Withstand Capability (SWC) Tests
7. ANSI Z97.1 – Laminated/Safety Tempered Glass

I. Definitions

1. Defective Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
2. Provide: Where used in this document, provide shall mean to install new device, apparatus, system, equipment or feature as specified in this document.
3. Definitions in ASME A17.1 as amended or modified by the AHJ apply to work of this Section.

1.3 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from General Contractor's or Filed Subcontractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.4 PERMITS AND SUBMITTALS

A. Permits

1. Comply with the requirements of Division 01.
2. Prior to commencing work specified by the Contract Documents, the Contractor shall, at its own expense, obtain all permits or variances as may be required by the AHJ and provide satisfactory evidence of having obtained said permits and variances to both the Owner's Representative and Consultant.
3. File necessary drawings for approval of all Authorities Having Jurisdiction.

B. Submittals

1. Comply with the requirements of Division 01.
2. Submit the following

a. Samples

Item No.	Quantity	Size	Description
S1	3	12" x 12"	Exposed finishes as requested by Architect

b. The samples shall be:

- 1) Held on site after inspection and used as a standard for acceptance or rejection of subsequent production units.
- 2) Labeled to identify their intended use and relation to the documents, e.g., car finishes, control panel, etc.
- 3) Returned to the elevator contractor at the completion of the project.

Subject to approval, where an item of equipment is a standard item, copies of the manufacturer's catalogue or brochure may be accepted provided that all dimensions and relevant information are shown in the catalogue or brochure.

c. Shop Drawings - Submit computer generated project specific layout drawings for approval. Include the following:

- 1) A listing of all components, devices and sub-systems including:
 - a) Manufacturer
 - b) Size and model number
- 2) Project Specific Control Room Plan indicating:
 - a) Location of equipment and code clearances
 - b) Service connections and disconnect switches

- 3) Fully dimensioned hoistway plan and section of each unit indicating:
 - a) Platform (with cab), hoistway and entrance dimensions
 - b) All running clearances
 - c) Location of fixtures
 - d) Buffers and pit reactions
 - e) Location of inserts
 - f) Rail Reactions
 - 4) Entrance details
 - 5) Sill support detail
 - 6) Fixture details including hall lanterns, hall pushbutton stations, car operating panel, etc.
 - 7) Wiring diagrams
 - 8) Insert diagrams
 - 9) Cab details including wall, ceiling, base, handrail, lighting, fixtures, front return and transom plans and sections
 - 10) MRL criteria including:
 - a) Location of machine and governor
 - b) Structural requirements and reactions
 - c) Clearances
3. Calculations
- a. Rail loads
 - b. Pit and machine room reactions
 - c. Heat emissions in machine room
 - d. Electrical loads including, accelerating and running currents. Include all auxiliary loads.
 - e. As required, submit design calculations identifying seismic design forces and support capacities. Calculations shall be certified by a registered professional engineer.
- C. Keys
1. Upon the initial acceptance of work specified by the Contract Documents on each unit, the Contractor shall deliver to the Owner, six (6) keys for each general key-operated device that is provided under these specifications in accordance with ASME A17.1, Part 8 standards as may be adopted and modified by the AHJ.
 2. All other keying of access or operation of equipment shall be provided in accordance with ASME A17.1 Part 8 as may be adopted and modified by the AHJ.
- D. Diagnostic Tools
1. Prior to seeking final acceptance of the project, the Contractor shall deliver to the Owner any specialized tools required to perform diagnostic evaluations, adjustments, and/or programming changes on any microprocessor-based control equipment installed by the Contractor. All such tools shall become the property of the Owner.
 - a. Owner's diagnostic tools shall be configured to perform all levels of diagnostics, systems adjustment and software program changes which are available to the Contractor.
 - b. Owner's diagnostic tools that require periodic re-calibration and/or re-initiation shall be performed by the Contractor at no additional cost to the Owner for a period equal to the term of the maintenance agreement from the date of final acceptance of the project.

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- c. The Contractor shall provide a temporary replacement, at no additional cost to the Owner, during those intervals in which the Owner might find it necessary to surrender a diagnostic tool for re-calibration, re-initiation or repair.
 2. Contractor shall deliver to the Owner, printed instructions, access codes, passwords or other proprietary information necessary to interface with the microprocessor-control equipment.
 - E. Wiring Diagrams, Operating Manuals and Maintenance Data
 1. Comply with the requirements of Division 01.
 2. Deliver to the Owner, four (4) identical volumes of printed information organized into neatly bound manuals prior to seeking final acceptance of the project.
 3. The manuals shall also be submitted in electronic format on non-volatile media, incorporating raw 'CAD' and/or Acrobat 'PDF' file formats.
 4. Manuals, as well as electronic copies, shall contain the following:
 - a. Step-by-step adjusting, programming and troubleshooting procedures that pertain to the solid-state microprocessor-control and motor drive equipment.
 - b. Passwords or identification codes required to gain access to each software program in order to perform diagnostics or program changes.
 - c. A composite listing of the individual settings chosen for variable software parameters stored in the software programs of both the motion and dispatch controllers.
 - d. Method of control and operation.
 5. Provide four (4) sets of "AS INSTALLED" straight-line wiring diagrams in both hard and electronic format in accordance with the following requirements:
 - a. Displaying name and symbol of each relay, switch or other electrical component utilized including identification of each wiring terminal.
 - b. Electrical circuits depicted shall include all those which are hard wired in both the machine room and hoistway.
 - c. Supplemental wiring changes performed in the field shall be incorporated into the diagrams in order to accurately replicate the completed installation.
 6. Furnish four (4) bound instructions and recommendations for maintenance, with special reference to lubrication and lubricants.
 7. Manuals or photographs showing controller repair parts with part numbers listed.
 - F. Training
 1. Prior to seeking final acceptance of the project, the Contractor shall conduct a one (1) hour training program on-site with building personnel selected by the Owner.
 2. The focus of the session shall include:
 - a. Instructions on proper safety procedures and who to contact for the purpose of assisting passengers that may become entrapped inside an elevator car.
 - b. Explain each control feature and its correct sequence of operation.
 3. Control features covered shall include but, not be limited to:
 - a. Independent Service Operation
 - b. Emergency Fire Recall Operation - Phase I
 - c. Emergency In-car Operation - Phase II
 - d. Emergency Power Operation
 - e. Emergency Communications Equipment
 - f. MA Medical Emergency Service
 - g. Security Operating Features (CCTV and keyless card reader)

- h. Remote Monitoring/Controls
- i. Emergency Hoistway Access and Rescue Features

G. Patents

- 1. Patent licenses which may be required to perform work specified by the Contract Documents shall be obtained by the Contractor at its own expense.
- 2. The Contractor agrees to defend and save harmless the Owner, Consultant and agents, servants, and employees thereof from any liability resulting from the manufacture or use of any patented invention, process or article of appliance in performing work specified in the Contract Documents.

1.5 QUALITY ASSURANCE

A. Structural, Mechanical and Electrical Design Parameters

- 1. The mechanical and electrical systems and the building structure have been designed for the following design loads:
 - a. Structural Loads:
 - 1) The pit, machine room and rail loads are shown on the drawings.
- 2. Power supply: 480V-3PH-60Hz (EE to verify)
- 3. Electrical Loads: (SE1) 20 HP
 - 27 A. FLR (Full Load Running)
 - 67 A. FLA (Full Load Acceleration)
- 4. Heat Release: 9,000 BTU/HR/UNIT
- 5. Submit a written statement with the bid that the above design loads and the clearance requirements shown on the Architectural drawings are acceptable for the proposed equipment. If not, specifically state the design variances.
- 6. After the award, if the type of equipment provided requires structure, mechanical and electrical system changes and/or revisions, the Elevator Contractor shall be responsible for all additional design and construction costs.
- 7. Electrical equipment, motors, controllers, etc., installed under this contract shall have necessary CSA/US or UL listing as may be required by the AHJ. Equipment shall be labeled or tagged accordingly.

1.6 DELIVERY / STORAGE / HANDLING / COORDINATION

A. Delivery and Storage of Material and Tools

- 1. Comply with the requirements of Division 01.
- 2. Delivery, Storage and Handling:
 - a. Deliver materials to the site ready for use in the accepted manufacturer's original and unopened containers and packaging, bearing labels as to type of material, brand name and manufacturer's name. Delivered materials shall be identical to accepted samples.
 - b. Store materials under cover in a dry and clean location, off the ground.
 - c. Remove delivered materials which are damaged or otherwise not suitable for installation from the job site and replace with acceptable materials.
- 3. The Owner shall bear no responsibility for the materials, equipment or tools of the Contractor and shall not be liable for any loss thereof or damage thereto.
- 4. The Contractor shall confine storage of materials on the job site to the limits and locations designated by the Owner and shall not unnecessarily encumber the premises or overload any portion with materials to a greater extent than the structural design load of the Facility.

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- B. Temporary Elevator (PROVIDE AS SEPARATE PRICE FROM BASE BID)
1. There may be a requirement for the use of an elevator during construction. Provide an alternate price for:
 - a. Temporary car enclosure.
 - b. Required guards and protective barriers.
 - c. Power and lighting.
 - d. Any special labor related to such temporary service.
 2. The Contractor shall also include all charges connected with:
 - a. Testing of the unit(s) for acceptance by the AHJ.
 - b. Maintenance required for temporary service.
 - c. Final clean down
 3. All equipment shall be restored to a "like new" condition at the Contractor's expense prior to acceptance of the work by the Construction Manager.

1.7 WARRANTY / MAINTENANCE SERVICES

A. Contract Close-Out, Guarantee and Warranties

1. Comply with the requirements of Division 01.
2. Guarantee and Warranties:
 - a. Warrant the equipment installed under these specifications against defects in material and quality of installation and correct any defects not due to ordinary wear and tear or improper use of car which may develop within one year from the date each unit is completed and placed in permanent operation and accepted by the Owner.
 - b. This warrantee shall be written and issued at the completion of each unit prior to final payment.

B. Maintenance

1. Warranty Maintenance: Provide full protective maintenance on the specified equipment for a period of twelve (12) months from the date of final acceptance of the entire installation as specified under the Full Protective Maintenance Service in "2" below.
 - a. The price for this service shall be included in the base price or as otherwise specified in the contract documents.
2. Full Protective Maintenance Service: All maintenance shall comply with Part 8 of the ASME A17.1 Code and modified or amended by the Authority Having Jurisdiction.
 - a. Maintenance work shall be performed by trained personnel directly employed and supervised by the service contractor.
 - b. Perform scheduled maintenance work and repairs during the regular working hours of regular working days of the trade. All work shall be coordinated with the Building Manager.
3. Provide emergency callback service and repair twenty-four (24) hours a day, seven (7) days a week, including holidays, between regular examinations at no extra cost to the Owner. The response time during working hours shall not exceed one (1) hour. Perform emergency repairs within four (4) hours to restore the equipment to operating order. The following conditions will require emergency callback services for elevators:
 - a. Passenger entrapment.
 - b. Failure or malfunction of control system.
 - c. Shutdown of any elevator.

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4. Maintenance shall include monthly examination, adjustment, lubrication, repair or replacement of electrical and mechanical parts of all equipment and apparatus.
 5. The maintenance services shall also cover relamping of machine room and pit lighting fixtures, signal and operating fixtures, communication system, cab ventilation system, monitoring and control panels. The disconnect means, fuses, car enclosures, car doors and hoistway entrances are excluded. Repair equipment whenever required and use only genuine standard parts produced and manufactured for equipment concerned.
 - a. Include a minimum of two (2) hours of monthly labor for the specified scheduled preventive maintenance service.
 - b. The performance of mandated inspections and tests of the equipment, as required by the AHJ, shall be included in this agreement.
 - 1) Where required by the AHJ, witnessing shall be performed by a third party licensed agency hired directly by the Owner.
 - 2) Where testing is required to be performed after normal business hours, Contractor shall invoice the after-hours work at the premium portion of the hourly billing rate only.
 - c. Provide firefighter and emergency power tests and inspections as may be required.
 - d. During every scheduled maintenance visit, make sure the machine room and pit areas are clean.
 - e. Adjust controls and maintain the equipment to meet the performance requirements as hereinafter specified.
 - f. If overtime repairs and maintenance services are requested and pre-approved by the Owner, the Contractor shall pay for the regular labor portion, and the Owner will cover the premium portion of the labor only.
 - g. Keep permanent record of inspections, maintenance services including lubrication procedures, emergency call-back services, repairs and replacements.
 - h. Maintain a complete set of updated wiring diagrams and schematic control diagrams in the machine room and provide the Owner with an additional record set.
 6. Supply all necessary lubricants, cleaning materials and repair parts required to keep the system in good working order during maintenance periods.
 7. Maintain an adequate stock of spare parts for maintenance or repair work and minor callback service repairs within the confines of the building in areas designated and assigned by the Owner. Maintain a catalog of spare parts available on site.
 8. Additional parts of other equipment required for maintenance and repair of the systems may be stored at the Contractor's facilities with the understanding delivery of same for emergency procedures must be made within two (2) hours to the job site.
 9. Other materials and equipment normally not stocked by the Trade Contractor locally must be available within twenty-four (24) hours for delivery to the job site from remote facilities and/or Supplier Contractors responsible to the Contractor for stocking the materials or equipment.
 10. If the requirements for stockade of parts as defined herein are not met on any item, immediately notify the Owner in writing as to the circumstances and provide a confirmed delivery date for the required materials and equipment.
 11. Should it become necessary to work on the equipment, proper safety barricades shall be erected to protect people from all hazards.
 12. If for any reason (such as strike), it is mutually agreed to temporarily reduce the level of maintenance, the monthly amount of the maintenance contract shall be reduced to reflect the reduction in maintenance services.

13. Should the Owner request that the maintenance Contractor perform any work on the equipment of this Contract, but not included in the terms of the Contract, then payment for such work shall be based on the rates included in the Contract for time and material.
14. Thirty (30) days before the annual renewal of this agreement, adjust monthly maintenance price as follows:
 - a. Eighty percent (80%) of the current maintenance price based on current straight-time hourly rate for a mechanic.
 - b. Twenty percent (20%) of the current maintenance price based on the established difference in the "Producer Commodity Prices for Wholesale Metals and Metal Products Index".
 - c. Notwithstanding anything to the contrary, the maximum annual increase shall not be more than three percent (3.0%) of the total contracted payment for the preceding contract year.
15. Cancellation: The Owner has the right to cancel this contract on thirty (30) days notice.

PART 2 - PRODUCTS

2.1 General Description

A. Elevator – SE1

1.	Quantity	One (1)
2.	Type	Machine Room-less - Passenger
3.	Capacity (lbs)	4,500
4.	Speed (fpm)	200
5.	Travel in Feet	41'-0"
6.	Roping/Ropes	2:1
7.	Number of Landings	Four (4) at floors 1 through 4
8.	Number of Openings	Same as landings
9.	Front Openings	All
10.	Rear Openings	None
11.	Operation	Simplex selective collective
12.	Control	Variable voltage variable frequency
13.	Fireman's Control	Phase I and II
14.	Number of Push Button Risers	One (1)
15.	Clear Inside	5'-8" wide x 8'-0" deep
16.	Guide Rails	Steel tees
17.	Buffers	Spring
18.	Car Door Size	4'-0" wide x 7'-0" high
19.	Hoistway Door Size	Same as car door
20.	Door Operation	Two speed side opening
21.	Machine Type	Gearless
22.	Counterweight Safety	Not Required
23.	Compensation	As required
24.	Power Supply	480V-3Ph-60Hz (EE to verify)
25.	CCTV and Card Reader	Provisions
26.	Voice Annunciator	Required
27.	MA Medical Emergency	Required

2.2 MANUFACTURERS

A. Pre-Approved Equipment Manufacturers

1. Original Equipment Manufacturers – Otis Underslung, TKE Evolution, Kone Monospace 500, Schindler 3300 XL.
2. In addition to Original Equipment Manufactures, the following manufacturer's equipment and materials have been pre-approved for use on this project.
 - a. Controller - GAL (GALaxy), Motion Control Engineering, Smartrise, or approved equal.
 - b. Fixtures - EPCO, Monitor, Innovation, or approved equal.
 - c. Cabs and Entrances - National Cab & Door, Velis, Gunderlin, Hamilton, Draper Columbia Elevator Products, United Cabs, or approved equal.
 - d. Machines - Hollister-Whitney, Imperial, Torin, or approved equal.
 - e. Motors - Imperial Electric, General Electric, Baldor, Reuland Electric, or approved equal.

2.3 CONTROL FEATURES / OPERATION

A. Motion Control

1. Smooth stepless acceleration and deceleration of the elevator car shall be provided in either direction of travel during both single and multiple floor runs.
2. Use digital logic to calculate optimum acceleration and deceleration patterns during each run.
3. Acceleration, deceleration, jerk, maximum velocity, leveling accuracy and elapsed flight time, for a typical elevator one floor run, shall not exceed values as further specified.

B. Simplex Selective Collective Operation

1. Provide simplex selective collective operation from a riser of hall push button stations.
2. The registration of one or more car calls shall dispatch the car to the selected floors.
 - a. The car shall also respond to registered hall calls in the same direction of travel.
 - b. Car and hall calls shall be canceled when answered.
3. Stops in response to calls that are registered in either the car or hall push button stations shall occur in the natural order of progression in which the floors are encountered, depending on the direction of car travel, and irrespective of the order in which calls are registered.
4. When the car has responded to the highest or lowest call, and calls are registered for the opposite direction, the car shall reverse direction automatically and respond to those registered calls.
5. When the car arrives at its last stop and reverses direction of travel, all previously registered car calls shall be automatically cancelled.
6. When the car arrives at a landing where both up and down hall calls are registered, it will answer the call in the direction of travel.
 - a. After a pre-determined delay, if no car call is registered, the car shall respond to calls registered for the opposite direction. Car doors shall close immediately, re-open and respond to the call for the opposite direction.
 - b. Hall lantern operation shall always correspond to direction of service.
7. When an empty car reverses direction at a landing with no hall calls, the doors shall not open and the hall lantern shall not operate.

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8. If the car has no car calls registered and arrives at a floor where both up and down hall calls have been registered, the car shall respond to the hall call corresponding to the last direction of car travel. If, after making its stop, a car call is not registered and no other hall calls exist ahead of the car corresponding to its original direction of travel, the doors shall close and immediately reopen in response to the hall call for the opposite direction.
 9. The car shall maintain its original direction at each stop until the doors are fully closed to permit a passenger to register a car call before the car reverses its direction of travel.
- C. Independent Service Operation
1. The car operating station shall be equipped with a key-operated switch labeled "IND SER".
 2. Locate the switch in the locked access compartment.
 3. When placed in the "on" position the following shall occur:
 - a. Existing hall call registrations shall extinguish and hall buttons shall remain inoperative as an indication to passengers that there is no elevator service.
 4. During Independent Service Operation, the elevator doors shall remain open at any landing until the door close or a car call push button is pressed and maintained until the doors are fully closed.
 5. If more than one (1) car call is registered, all registered car calls shall extinguish when the elevator stops in response to the first call.
 6. Fire Emergency Recall shall automatically override Independent Service Operation and engage Phase I - Fire Emergency Recall Operation following a period of approximately forty-five (45) seconds.
- D. Inspection Service Operation
1. Provide a key operated switch in the main car operating panel that, when turned to the 'ON' position, shall cause the elevator to be removed from service and placed in Inspection Service Operation.
 2. The car shall move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with both the hall and car door panels in the closed and locked position.
 3. The Inspection Service switch shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
 4. The top of the elevator car shall be equipped with a control for limited operation of the car during repairs, maintenance and inspection conducted in the hoistway. The transfer of control to the top of car operating device shall cause that device to be the sole means of control for the elevator.
 - a. Visual and audible indication shall be provided on the top of the car when Firefighters' Emergency Operation is initiated.
 5. Power door operating equipment shall be rendered inoperative while the car is being operated in the Inspection Service mode with the exception of power closing of the door. The control system shall maintain closing power on the door while the elevator is moving under Inspection Service Operation.
 6. The in-car Inspection Service switch shall be rendered ineffective when the top of car inspection control is activated.
 7. Machine Room Inspection Operation and Inspection Operation with open door circuits shall be provided in accordance with A17.1 Safety Code, as modified and adopted, where required or allowed by the AHJ.

E. Hoistway Access Operation

1. Provisions shall be made to allow access to the hoistway through the use of hoistway access switches.
2. Operating the access switch shall permit the car to move at a speed not to exceed 150 feet per minute (0.75 meters per second) as per code with the hall and car doors in the open position to obtain access to the top of the car or climb-in pit.
3. The car shall automatically stop motion when the car top is level with the hoistway door sill for access to top of car.
4. The access key switch(es) shall be keyed differently than other typical keys used in the operation of the elevator. Keying shall be in accordance with Security Group Classifications as required by applicable code.
5. Access operation shall be disabled when top of car inspection operation is in effect.

F. Load Weighing Operation

1. A positive means shall be provided to continuously monitor the amount of load being transported by the elevator car.
2. The system shall be used to;
 - a. Preload static motor drives
 - b. Activate control features that include:
 - 1) Anti-nuisance operation
 - 2) Load dispatch operation
 - 3) Load dependent non-stop operation where applicable.
3. The anti-nuisance feature shall operate at loads not exceeding 200 lbs., whereas load dispatch and load non-stop shall be set to function at 65% of the rated loading capacity for the initial set up and adjustment procedure.

G. Firefighters' Emergency Operation

1. Firefighters Service Operation and devices shall meet applicable code requirements of the AHJ.
2. Contractor shall be responsible for compliance in all aspects of Firefighters Service including, but not limited to the mode of operation, initiation of operation, operating control and signaling devices as well as fixture engraving including operating instructions applicable to and where required by the AHJ.

H. Emergency Power Operation

1. Upon loss of normal power, and establishing of emergency power, all elevators shall automatically resume normal operation.
 - a. Elevators shall start sequentially so as to prevent overloading of the emergency power system.
 - b. Sequential transformer connection operation shall be employed where necessary to reduce half-cycle inrush currents.
2. An illuminated signal marked "ELEVATOR EMERGENCY POWER" shall be provided in the designated main hall push button station to indicate that the normal power supply has failed and the emergency power is in effect.
3. Prior to return to normal power, the building ATS shall provide a "pre-transfer" signal to the elevator equipment that will initiate the landing of elevators prior to transfer from emergency power to normal power.
 - a. Timer of the pre-transfer signal shall be adjustable from fifteen (15) to thirty (30) seconds.

4. The following additional requirements apply:
 - a. Firefighters' Service Operation, if in effect, will remain active at all times during emergency power operation.
 - b. Car lighting will remain active with car lighting on separate emergency power feeders in addition to battery back-up.
 - c. Communications will remain active at all times on emergency power feeders in addition to battery back-up.
 - d. Remote monitoring, where provided, will be active from each group dispatcher for selected elevators using an uninterrupted power supply (UPS) to maintain the central processing unit during power transfers.
 - e. Position indicator for each elevator will be active in the selected elevator and security room (where applicable), as well as lobby display panels.
 5. Testing of elevators under emergency power shall be accomplished with the building ATS providing necessary "pre-transfer" signals to the elevator control apparatus.
 - a. Prior to testing, the building ATS shall provide a "pre-transfer" signal to initiate the landing of the elevators prior to the transfer from normal to emergency power.
 - b. After testing, the building ATS shall provide a "pre-transfer" signal to initiate the landing of the elevators prior to the transfer from emergency to normal power.
- I. Elevator Safety Requirements for Seismic Design Category B
1. Guarding of equipment, machine supports, guide rail systems, the design of counterweight car frame and platform, safeties and signaling devices shall meet the requirements of ASME A17.1 as may be modified by the AHJ.
 2. Guide rails, guide rail supports and their fastenings shall meet requirements for the seismic zone.
- J. Floor Lockout Feature / Keyless - Card Reader Control / Wiring Provisions
1. Wiring: Provide six (6) pair of 20 gauge two (2) flexible conductor low voltage cables with an overall braided shield in the traveling cable of all elevators for card reader interface.
 - a. The cables shall extend from the security interface terminal cabinet in the elevator machine room to behind the elevator return panel above the space allotted for the card reader.
 - b. Terminate the cable to dual screw barrier terminal strips on each end.
 2. Card Reader Space: Allocate card reader space in each main car station as directed by the Architect. Provide a flush Lexan lens and mounting provisions for the card reader unit which is provided by others.
 3. Interface: For floor programmable card access control in all elevators, provide a pair of terminals for all floors such that application of a momentary dry (no voltage present) contact closure across those terminals by the security system shall enable the selection of the corresponding floor from the floor selector button in the elevator cab.
 - a. Locate the terminals inside an interface terminal cabinet in the elevator machine room.
 - b. Provide all relays required to interface the elevator control system to the momentary dry contact closures provided for under another section of these specifications.
 - c. If applicable, the card reader shall be operable and compatible with the issued card keys used building wide.
 - d. Coordinate system requirements with the manufacturer of the issued card key system.

4. The card reader operation shall bypass floor cut-out switches.
 5. Firefighters' Service Operation shall override Floor Lockout Feature.
- K. CCTV Camera Surveillance of Elevator
1. A camera shall be installed to provide for camera surveillance of the elevator.
 2. The CCTV camera interface traveling cable shall be two (2), RG-59U stranded center conductor coax cables and one (1), two (2) conductor 20 gauge stranded, low voltage cable with an overall braided shield and drain wire.
 3. The CCTV camera shall be provided by the security contractor and installed by the Elevator Contractor.
 - a. The security contractor shall provide supervision, wiring details and installation diagrams to the Elevator Contractor.
 4. The exact card reader and CCTV camera locations shall be specified by the Architect.
 5. Traveling cables for the CCTV camera shall extend from the elevator / security interface terminal cabinet in the elevator machine room to the top of the elevator cab. Provide an excess loop of 10 feet of cable at each end.
 6. Provide all conduit, power and wiring required for the installation of the terminal cabinet, traveling cables and interfacing to the elevator control system.
 7. Provide one (1) 120V duplex unswitched outlet dedicated to security on top of each elevator equipped with CCTV camera.
 8. The security contractor shall provide all wiring from the interface terminal cabinet to the security system.
- L. Passenger Rescue Feature
1. Provide a device in the control room to move the elevator car to a floor landing in the event of controller or power failure.
 - a. This device must be speed controlled to prevent an overspeed condition.
 - b. A line of sight must be provided between the Passenger Rescue Feature device and the elevator car.
 - 1) Coordinate line of sight requirements with the control room requirements.
 2. Provide a manual brake release lever attached to the control cabinet for rescue of passengers.
 - a. A visual display shall be provided with the control cabinet, which indicates car position, speed and directions.
- M. Door Operation
1. Car and hoistway doors shall be arranged to operate in unison without excessive noise or slamming in either direction of travel.
 - a. Door opening speeds of two (2) feet per second shall be provided in conjunction with closing speeds of 1.0 feet per second in accordance with governing code.
 - b. Door operation shall commence as the car stops level at the floor and the machine brake is applied. Pre-door opening shall not be permitted.
 2. Where the hoistway door and the car door are mechanically coupled, the kinetic energy of the closing door system shall be based upon the sum of the hoistway and the car door weights, as well as all parts rigidly connected thereto, including the rotational inertia effects of the door operator and the connecting transmission to the door panels.
 3. The force necessary to prevent closing of the car and hoistway door from rest shall not exceed 30 lbf. This force shall be measured on the leading edge of the door with the door at any point between one third and two thirds of its travel.

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4. Door open and door close time shall be measured between the moment car door operation in either direction begins and the instant at which that cycle is completed.
 5. When responding to either a car or corridor call, the amount of time that the elevator door remains stationary in the open position shall be adjustable up to sixty (60) seconds.
 - a. Door open dwell time for a corridor call shall be separate of that for a car call, and in both cases, dwell time shall be canceled whenever the car door protection device is momentarily interrupted by passenger transfers, followed by a reduced door open dwell time of approximately one (1) second (adjustable) after the door protection device is cleared of obstructions.
 6. The operation of the door protective device by physical contact (mechanical safety-edge) or the interruption of one or more infrared light beams (dual or multi-beam non-contact) during the close cycle shall cause the immediate reversing of the doors to the full open position.
 7. The door closing cycle shall be arranged so that, in the event the door protective devices become continually obstructed after the normal door open dwell time has expired, and following a time interval of approximately thirty (30) seconds (adjustable), a warning tone shall sound and the door closing cycle shall commence at reduced speed and torque per applicable Code requirements.
 8. Each car operating station shall be provided with a "door open" and "door close" push button.
 - a. Pressure on the "door open" button shall cause doors in the full open position to remain so and doors engaged in the close cycle to reverse direction and assume the full open position so long as pressure remains applied to the button.
 - b. The "door open" buttons shall also control the open cycle during Phase II - Emergency In-car Operation.
 - c. The "door close" push button shall function on Independent Service and Phase II - Emergency In-car Operation as well as during normal automatic operations.
 9. Each car operating station shall be provided with a "door hold" push button.
 - a. Pressure on the "door hold" button shall cause doors in the full open position to remain in the open position and doors operating in the close cycle to reverse direction and travel to the full open position for an extended (adjustable) period of time to allow for loading and unloading.
 - b. The "door hold" feature shall be overridden when the elevator is on Fire Emergency Phase I and Phase II.
 - c. The "door hold" feature shall be cancelled when the "door close" button is pressed.
 10. Repeated attempts by the power door operator to open or close the door at any landing shall be monitored by the control system.
 - a. In the event the door fails to cycle properly after a preset (adjustable) number of attempts, the car shall either travel to the next stop or remove itself from service, depending upon whether the malfunction is in the open or close cycle.
 11. Each hoistway door shall be provided with an automatic self-closing mechanism arranged so that the door shall close and lock if the car should leave the landing while the hoistway door is unlocked.
 12. Car doors shall be arranged to prevent their being manually opened from inside the car unless the elevator is positioned within a floor landing zone.

2.4 MACHINE ROOM / SECONDARY EQUIPMENT

A. Controller

1. The elevator shall have a microprocessor-based controller.
2. Digital logic shall calculate optimum acceleration, deceleration and velocity patterns for the car to follow during each run.
3. Closed-loop distance and velocity feedback shall monitor the actual performance of the elevator car with the desired speed profile.
4. System operating software shall be stored in non-volatile memory.
5. Elevator control relays, contactors, switches, capacitors, resistors, fuses, circuit breakers, overload relays, power supplies, electronic circuit boards, microprocessors, static motor drive units, wiring terminal blocks and related components shall be totally enclosed inside a free-standing metal cabinet with hinged access doors.
 - a. Provide natural or mechanical ventilation for the controller cabinets.
 - b. Equip the vent openings and exhaust fans with filters.
6. Mount equipment to moisture-resistant, noncombustible panels supported from the steel frame.
7. Provide "noise filter" between hoistway wiring and controller/dispatchers to eliminate interference.
8. Optically isolate communication cables between components.
9. Wiring: Wiring on the units, whether factory or field wiring, shall be done in neat order, and all connections shall be made to studs and/or terminals by means of grommets, solderless lugs or similar connections. All wiring shall be copper.
10. Terminal Blocks: Provide terminal blocks with identifying studs on units for connection of board wiring and external wiring.
11. Marking: Identifying symbols or letters shall be permanently marked on or adjacent to each device on the unit, and the marking shall be identical with marking used on the wiring diagrams. In addition to the identifying marks, the ampere rating shall be marked adjacent to all fuse holders.
12. The manufacturer's standard on-board "LCD" display shall be incorporated on the main processor board and/or otherwise incorporated in the controller cabinet. The "LCD" shall be capable of providing alpha-numeric characters to view the operational status of the elevator and/or group functions depending on the application. The display shall provide the user with necessary information for troubleshooting and reprogramming of the basic system parameters.
 - a. Where the "LCD" is not an integral part of the controller and troubleshooting/reprogramming requires the use of a separate tool, the tool shall be maintained in the machine room and accessible to service personnel. This tool, along with all technical documentation for the correct use of the tool, shall remain the property of the Owner.
 - b. Password protection of critical programming features is required to prevent accidental changes to life-safety and other non-typical control settings.
 - c. Where a separate dispatch or group control panel is provided, a separate "LCD" display shall be provided to view group functions.
13. In the event diagnostics and monitoring is accomplished via Field Service Tools, provide the required Field Service Tools with related control system appurtenances for diagnostic evaluations, system monitoring and field adjustments.
 - a. Provide instructions for proper use of such diagnostic tools and/or equipment with all coding and other operational requirements.

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- b. Maintain and calibrate the diagnostic tools, and update the associated instructions and other related documents under the service agreement.
 - 1) Should the agreement be cancelled for any reason by either party, maintenance and updating of diagnostic tools shall be provided to the Owner at the Contractor's cost without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment provider.
 - 2) The Owner may request field and technical instructions be provided by the original installation contractor or manufacturer for proper servicing by other qualified elevator company personnel.
 - 3) The established cost plus profit, as previously specified, shall be applicable for the life of the system.
 - a) If the equipment for fault diagnosis is not completely self-contained within the controllers but requires a separate detachable device, that device shall be furnished to the Owner as part of this installation.
 - b) Such device shall be in possession of and become property of the Owner.
 - 14. Microprocessor Documentation
 - a. Provide and/or obtain complete information on systems' design, component parts, installation and/or modification procedures, adjusting procedures and associated computer conceptual logic circuitry and field connection.
 - b. Provide microprocessor upgrading and/or modifications to programs that have been assigned to enhance the operation of the equipment for a period of ten (10) years after project approval.
 - B. Machine Beams
 - 1. Provide support beams, angles, plates, rails, bearing plates, blocking steel members to support machines, governors, deflector and overhead sheaves. The machinery and deflector sheaves shall be located within the hoistway as shown on the drawings. Coordinate attachments of the machine beams to the building structure with the structural drawings.
 - 2. Mounting of the hoist machine and deflector sheaves shall incorporate isolation to minimize the transmission of noise and/or vibration to the building structure.
 - C. Gearless Elevator Hoisting Machine
 - 1. Provide a permanent magnet synchronous motor (PMSM) gearless traction machine, specially designed and manufactured for elevator service. The machine shall have high starting torque and low starting current, rated for 50^o C (90^o F) continuous operation, and a minimum of 210 starts per hour.
 - a. Securely mount the machine to overhead steel beams or to the guide rail system.
 - b. The armature shaft shall be supported in ball or roller type bearings.
 - c. The driving sheave shall be cast from the best grade of metal with a Brinell hardness of 215 to 230 and shall be machined with grooves, providing maximum traction with a minimum of rope and sheave wear.
 - d. Ensure that adequate ventilation of internal stator windings and rotating element is provided to prevent overheating with thermal overload protection. (Constant velocity fan for constant cooling.)
 - e. Equip housing with eyebolt(s) for lifting.
 - f. Provide the machine with an electro-mechanical brake.
 - 1) The brake shall be spring applied and electrically released where drum or disk-type brakes are employed.

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- 2) Design the brake electro-magnet for quick release and application of the brake.
 - 3) The brake lining material shall be non-asbestos.
 - g. Design the brake for quick release to provide smooth and gradual application of the brake shoes.
 - 1) An emergency brake shall be an integral part of the machine design.
 - h. Provide a sheave guard and rope retainer on the machine sheave to prevent hoisting rope from jumping off the grooves.
 - 1) Provide service platforms, grating, handrails, ladders and required accessories to service and maintain the hoisting machines, if required by the local AHJ.
 - i. Design and construct the hoisting machine based on passenger elevator cab enclosure weight as specified and as shown on the architectural drawings.
- D. Machine Brake
- 1. Provide an electro-mechanical brake.
 - a. Drum or disk-type brakes shall be spring applied and electrically released.
 - b. Design the brake electro-magnet for quick release and application of brake shoes.
 - c. Swivel type brake shoes shall be applied to the braking surface (pulley or disk).
 - d. The brake lining material shall be non-asbestos and shall be attached to two (2) cast iron shoes.
 - e. The brake pulley or disk shall act as the coupling between the drive motor shaft and the worm shaft.
 - 2. The brake shall be designed and adjusted to safely hold 125% of rated full load capacity in accordance with applicable code.
- E. VVVF AC Drive
- 1. Provide a solid-state, variable voltage, variable frequency (VVVF), 3-phase AC hoist motor drive system as part of the microprocessor-based equipment.
 - a. VVVF drive system shall be a low-noise, flux-vector inverter device.
 - b. Include a digital LED readout and touch-key pad to facilitate software parameter adjustments, monitor system operation and display fault codes.
 - 2. The drive shall utilize a 3-phase, full wave rectifier and capacitor bank to provide direct current power for solid-state inversion.
 - 3. The inverter shall utilize IGBT power semiconductors and duty cycle modulation fundamental frequency of not less than one kilohertz to synthesize 3-phase, variable voltage variable frequency output.
 - 4. The system shall be designed and configured with the following countermeasures for noise generated by the pulse-width modulated (PWM) inverters.
 - a. Control of radiated noise via inverter and/or motor cables.
 - b. Conducted noise through power lines.
 - c. Induction noise and ground noise.
 - 5. Inverter shall be encased in metal and independently grounded.
 - 6. A noise filter for the input power line shall be provided to prevent penetration into radios, wireless equipment and smoke detectors.
 - 7. A 3% three-phase line reactor shall be provided on the power system rated at the utility voltage input to the drive and sized for the rated drive current.

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8. The drive shall:
 - a. Be configured as a complete digital drive system.
 - b. Be totally software configurable.
 - c. Interface with external equipment/signals via either discrete local I/O connections or high speed Local Area Network (LAN).
 - d. Be located within the limits of the control cabinet (where system size allows) or separately mounted in an appropriate chassis with hinged swing-out doors with clearances equal to the cabinet width dimensions.
 - e. Provide programmable linear or S-curve acceleration.
 - f. Provide free run or programmable linear or S-curve deceleration.
 - g. Have controlled reversing.
 9. Operating and Environmental Conditions:
 - a. Have a service factor of 1.0.
 - b. Rated for continuous duty.
 - c. Humidity - 90% rated humidity non condensing.
 - d. Cooling - forced air when required.
 - e. Digital display for:
 - 1) Running - output frequency, motor RPM, output current, voltage.
 - 2) Setting - Parameters values for setup and review.
 - 3) Trip - separate message for each trip, last thirty (30) trips to be retained in memory.
 10. Protective Features:
 - a. Motor overspeed.
 - b. Adjustable current limit.
 - c. Isolated control circuitry.
 - d. Digital display for fault conditions.
 - e. Selectable automatic restart at momentary power loss.
 - f. Manual restart.
 - g. Over/Under Voltage.
 - h. Line to line and line to ground faults.
 - i. Over-temperature.
- F. VVVF AC Drive - Regenerative Module
1. The system shall provide full regenerative capabilities to control overhauling motor speed and reduce hoist motor deceleration time by allowing overhaul power to be discharged back into the power lines.
 - a. The regenerative section may be an integral part of the drive or a stand-alone unit mounted in a separate cabinet with proper ventilation as required by the manufacturer.
- G. Overspeed Governor
1. Provide a speed governor, located overhead, to operate the car safety.
 - a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.
 - 1) Springs used to develop the tension are not acceptable.
 - b. Provide rope grip jaws, designed to clamp the governor rope to actuate the car safety upon a predetermined overspeed downward.
 - 1) The centrifugal type governor shall trip and set rope jaws within 60 degrees of governor sheave rotation after reaching rated tripping speed.

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- c. Design the governor rope tripping device so that no appreciable damage to or deformation of the governor rope shall result from the stopping action of the device in operating the car safety.
 - d. Provide an electrical governor overspeed protective device which shall remove power from the driving machine motor and brake before or at the application of the safety.
 - 1) The setting for the overspeed switch shall be as prescribed in the ASME A17.1 Safety Code.
 - 2) Locate and enclose the switch to insure that excess lubrication will not enter the switch enclosure.
 - 3) Overspeed switch shall operate in both direction of travel on systems employing a static power drive unit.
 - e. Seal and tag the governor with the running speed, tripping speed and date last tested.
 - f. Design the governor to prevent false tripping due to conditions caused by rope dynamics.
 - g. Governor shall be mounted to the guide rail system or machine beam supports in the hoistway overhead.
 - 1) Coordinate access requirements and testing procedures with the AHJ.
 - 2) Where governor access is not required by the AHJ, governor shall be capable of being manually reset from outside the hoistway.
- H. Equipment Isolation
- 1. Provide effective sound isolation between machines, secondary deflector sheaves, solid state motor drive units and filters, from building structure to reduce noise transmission to occupied spaces and elevators and elevator cabs.
 - 2. When operating per plans and specifications, the elevator equipment shall not generate noise levels in excess of NC-40 in occupied tenant spaces and shall be free of pure tones. For the purposes of this specification, a pure tone shall be defined as a sound level in any one-third octave band which is greater than 5 dB above both adjacent one-third octave bands, in the range 45 to 11,200 Hz.
 - 3. Provide the following as a minimum:
 - a. Resiliently isolate the entire elevator/secondary deflector integral unitized base from the elevator machine room floor slab by means of effective neoprene-in-shear isolators having a minimum static deflection of 3/8".
 - b. Isolate the transformers and reactance units from the building structure by means of approved neoprene-in-shear isolators having a minimum static deflection of 3/8".
 - c. Solid state rectification units shall be mounted on 3/4" thick minimum, neoprene-in-shear pad isolators and an effective electrical filter/reactance limiting electrical noise shall be provided.
 - d. Use flexible conduit with ground wire for motor, machine, drive, governor and position/velocity transducer connections.
- I. Overhead Stop Switch
- 1. Provide a positive action stop switch at the following locations as required by applicable code:
 - a. Overhead space.

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2. The switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.
 - a. Clearly identify the switch with permanent marking on the switch cover that indicates "RUN" and "STOP" positions.
- J. Emergency Brake
1. Ascending Car Overspeed Protection Device
 - a. Provide a device designed to prevent an ascending elevator from striking the hoistway overhead structure.
 - b. The device shall decelerate the car with any load up to the rated capacity by applying an emergency brake.
 - 1) The device shall detect an ascending car overspeed condition of not greater than 10% higher than the speed that the car governor is set to trip.
 - 2) The device, when activated, shall prevent operation of the car until the device is manually reset.
 - 3) The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.
 2. Unintended Car Movement Protection Device
 - a. Provide a device to prevent unintended car movement away from the landing when the car and hoistway doors are not closed and locked.
 - 1) The device shall prevent such movement in the event of failure of:
 - a) The electric driving machine motor.
 - b) The brake.
 - c) The machine shaft or shaft coupling.
 - d) Machine gearing.
 - e) Control system.
 - f) Any component upon which the speed of the car depends.
 - g) Suspension ropes and the drive sheave of the traction machine are excluded.
 - 2) The device shall prevent operation of the car until the device is manually reset.
 - 3) The device shall meet the requirements of the ASME A17.1 Safety Code as may be modified by the AHJ.

2.5 HOISTWAY EQUIPMENT

- A. Guide Rails / Inserts / Brackets
1. Provide machined, standard size steel "T" section guide rails with tongue and grooved joints for the car and counterweight. Use not less than 12.0-pound car and counterweight rails.
 2. Use not less than 3/4" thick machined steel fishplates to form rail joints. Connect rails to fishplate with four (4) bolts.
 3. As required, the section modulus and moment of inertia of the fishplates shall not be less than that of the rail.
 4. For concrete and concrete block hoistways furnish rail brackets and provide inserts and an insert location drawing to Construction Manager or General Contractor.
 5. Brackets shall be used to support the rails from the hoistway framing and/or inserts.
 - a. The rails shall be attached to the brackets by heavy clamps or clips.
 - b. Bolting or welding rails to brackets shall only be allowed in certain instances.
 - c. Do not attach brackets to the top flange of hoistway framing steel.

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6. All guide rails shall be erected plumb and parallel to a maximum deviation of 1/8 inch (plus or minus 1/16 inch).
 7. Provide oversized steel members and brackets for the rails where the distances exceed the manufacturer's standard dimensions.
- B. Counterweight Assembly / Frame
1. Counterweight shall consist of a steel frame welded or bolted together and necessary steel sub-weights.
 - a. Sub-weights shall be held within the frame by not less than 2 tie-rods passing through holes in all weights with rods equipped with locknuts, secured by washers and cotter pins at each end.
 - b. The counterweight shall be equal to the weight of the elevator car and approximately 40% to 50% of the contract (specified) capacity.
 - c. Provide the required pit counterweight guard where no compensation is used.
 - d. The bottom of the counterweight shall have a buffer striking plate and means to attach knock-off blocks to compensate for varying rope length.
- C. Roller Guides
1. Provide roller guide shoes with adjustable mounting base, rigidly bolted to the top and bottom of each side of the car and counterweight frame.
 - a. Roller guides shall consist of a set of sound reducing neoprene wheels in precision bearings held in contact with the three finished rail surfaces by adjustable stabilizing springs.
 - b. The bearings shall be sealed or provided with grease fittings for lubrication.
 - c. Equip roller guides with adjustable stops to control postwise float.
 - d. Fit the top car roller guides with galvanized, painted or powder coated steel guards.
 2. Approved applications and manufacturers:
 - a. OEM type equipment, G.A.L., ELSCO Model B for car roller guides and ELSCO Model D for counterweight guides or approved equal.
- D. Hoist Ropes
1. Pre-formed traction steel wire rope, specifically constructed for elevator applications, shall be provided for suspension of the elevator car and counterweight assembly.
 - a. Fastenings shall be accomplished by use of individual tapered rope sockets (wedge clamp) with adjustable shackles.
 - b. General design requirements for rope shackles and the method of securing wire rope shall conform with ASME A17.1 elevator safety code as modified by, and/or in addition to codes and standards accepted by the AHJ.
 - c. Provide machine-room-less elevators with hoist ropes having steel core.
 2. Provide anti-spinout as required by applicable code at all shackles where applicable.
 3. Coated steel belts with steel cords embedded in polyurethane case may be used in lieu of conventional steel hoist ropes subject to approval of the AHJ.
 - a. Belts shall be UL listed and non-combustible.
- E. Governor Rope
1. Pre-formed wire rope specifically constructed for elevator applications, shall be provided for governor ropes.
 - a. Rope shall be traction steel or iron in accordance with OEM design requirements.

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- b. Rope diameter and method of fastening shall be in accordance with ASME A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.
- F. Compensation Chain (AS REQUIRED)
- 1. Provide vinyl encapsulated compensating chain.
 - a. The quantity and size of the chains shall be calculated in accordance with the manufacturer's guidelines based upon the number, diameter and construction of hoist cables being used.
 - b. Final attachment of each compensating chain underneath the car and counterweight frame shall be accomplished by means of 'U-bolts'.
 - c. Intermediate support for each chain shall be provided 24" to 39" from the point of final attachment underneath the elevator car by use of an S-hook and separate U-bolt.
 - 1) Arrange compensation attachment points to maintain recommended loop dimension established by the compensation manufacturers.
 - d. Provide a guidance system designed to prevent cable sway.
 - e. The use of a single compensating chain if not centered on the car and counterweight is unacceptable.
 - 2. Provide manually reset electric switch to monitor each compensating chain connection at the elevator platform which shall stop the elevator immediately upon failure of one or more of the "S" hooks.
- G. Electrical Conduit / Wiring / Traveling Cable
- 1. Electrical wiring shall be provided.
 - a. All wiring shall be stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
 - b. Electrical wiring provided for hoistway interlock shall be of a flame retardant type, capable of withstanding temperatures of at least 392 degrees Fahrenheit. Conductors shall be Type SF or equivalent.
 - c. Each run of electrical conduit or duct shall contain no less than 10% spare wires and, in any case, no fewer than two (2) spare wires.
 - d. Crimp-on type wire terminals shall be used where possible.
 - 2. Traveling cable shall be provided.
 - a. Each traveling cable shall be provided with a flame and water resistant polyvinyl chloride jacket.
 - b. Electrical wiring shall consist of stranded copper conductors, manufactured in compliance with ANSI/ASTM B174-71 and UL 62 requirements, and polyvinyl chloride insulation complying with ETT requirements of UL 62 and Article 400 of the National Electric Code.
 - c. Each traveling cable shall contain no less than 10% spare wires.
 - d. Traveling cable exceeding 100' in length shall be provided with a steel wire rope support strand from which the cable shall be suspended.
 - e. Traveling cable must be contained within an approved electrical conduit to within 6' of the final suspension point in the hoistway.
 - f. Each traveling cable shall be arranged to provide no fewer than six (6) individually shielded pairs of 20-gauge wire and arranged to contain no less than one (1) coaxial cable for CCTV remote monitoring.

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- g. Traveling cable conductors that terminate at a hoistway center box shall be connected to stud blocks provided for that purpose.
 - 1) Each wiring terminal shall be clearly identified by its nomenclature as shown on the "as built" wiring diagrams and solderless, crimp-on type wire terminals shall be used where possible.
 - h. The attachment of a traveling cable to the underside of the elevator car shall be performed so that a minimum loop diameter of 30x the cable diameter is provided.
 - i. Pre-hang the cables for at least twenty-four (24) hours with ends suitably weighted to eliminate twisting during operation.
3. Rigidly supported EMT conduit, flexible metal conduit and galvanized steel trough shall be utilized throughout the hoistway.
- a. Both EMT and flexible conduit shall be connected on either end by use of compression fittings and secured in place with metal clamps sized in accordance with the diameter of conduit utilized.
 - 1) Wire or plastic wire ty-raps shall not constitute an acceptable means of fastening.
 - b. The use of flexible metal conduit shall be limited to runs not greater than 3' in length.
- H. Normal and Final Terminal Stopping Devices
- 1. Provide normal terminal stopping devices to stop the car automatically from any speed obtained under normal operation within the top and bottom overtravel, independent of the operating devices, final terminal stopping device and the buffers.
 - 2. Provide final terminal stopping devices to stop the car and counterweight automatically from the speed specified within the top clearance and bottom overtravel.
 - 3. The terminal stopping devices shall have rollers with rubber or other approved composition tread to provide silent operation when actuated by the cam fixed to the top of the car.
 - a. Terminal stopping devices that are not mechanically operated (i.e.: magnetic proximity) shall be provided by the manufacturer of the control equipment, intended for use as a terminal limit, and designed for reliable operation in the hoistway environment.
 - 4. Final terminal limits shall be pinned so as to prevent movement after final adjustment where required by the AHJ.
- I. Emergency Terminal Speed Limiting Device
- 1. Provide necessary emergency terminal speed limiting devices where reduced stroke buffers are used.
 - a. Operation of the device shall be independent of the operation of the normal terminal stopping device.
 - b. Arrange the device to automatically reduce the car and counterweight speed by removing power from the driving machine motor and brake so that the rated striking speed of the buffer is not exceeded at the time of impact.
 - c. The sensing device shall be independent of the normal speed control system.
 - d. Short circuits caused by grounds or other conditions shall not prevent the operation of the device.

2.6 PIT EQUIPMENT

A. Car and Counterweight Buffers

1. Provide buffer with necessary blocking and horizontal steel braces under the car and counterweight.
2. Provide spring type buffers.
3. The buffer shall be tested and approved by a qualified testing laboratory.
4. Provide a permanent buffer marking plate which indicates the manufacturer's name, identification number, and rated impact speed.
5. Provide a permanent data plate in the vicinity of the counterweight buffer indicating the maximum designed counterweight runby.
6. Support buffers from the pit floor level with all required blocking and bracing steel members.

B. Governor Rope Tension Assembly

1. Provide a governor rope tension assembly.
 - a. Maintain the proper tension in the governor rope with a weighted tension sheave located in the pit.
 - 1) Springs used to develop the tension are not acceptable.
 - b. The sheave shall be of proper diameter and set directly plumb with the governor rope drop to prevent the rope from pulling off of the sheave at an angle.
 - c. Lubrication fittings shall be provided on the assembly.
 - d. The assembly shall have necessary rope guards to prevent accidental contact of the rope/sheave by service personnel and to prevent the governor rope from jumping off of the sheave.

C. Pit Stop Switch

1. The elevator pit shall be provided with a push/pull or toggle switch that is conspicuously designated "EMERGENCY STOP" and located so as to be readily accessible from the hoistway entrance on the lowest landing served at a height of approximately 18" above the floor.
 - a. This switch shall be arranged to prevent the application of power to the hoist motor and machine brake when placed in the "OFF" position.

2.7 HOISTWAY ENTRANCES

A. Hoistway Entrance Structure

1. Frames - The frames shall be constructed of 14-gauge sheet steel.
2. Doors - The doors shall be constructed of 16-gauge sheet steel, not less than 1-1/4" thick, reinforced to accept hangers, interlocks or door closers.
3. Equip all hoistway landing doors with one-piece full height non-vision wings of material and finish to match hall side of door panels.
4. Entrances shall bear 1 ½ hour label of Underwriters Laboratories, Inc.
5. Provide each door panel with two (2) removable laminated plastic composition guides, arranged to run in sill grooves with a minimum clearance, replaceable without removing the door from the hangers and incorporating a steel fire stop.
6. In multi-speed door arrangements, provisions shall be made to interlock the individual panels so all panels close should the normal door panel relating means fail.
7. Provide rubber bumpers at the top and bottom of the door to stop them at their limit of travel in opening direction.

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8. Sills - Provide narrow-type, extruded sills with the nosing approximately one (1) inch deep and running the full length of door travel.
 - a. The sills shall be at least 3/8 inch thick.
 - b. The wearing surface shall be of a non-slip type.
 - c. Rigidly secure the sills to the building construction by means of steel sill support brackets or blocking with necessary metal shimming or adjustments.
 - d. Provide and rigidly secure sill support members to the building structure after blocking and leveling them with necessary metal shimming.
 - 1) Use 4" x 4" x 1/4" angle for single speed entrances and 5" x 5" x 3/8" angle for two speed entrances.
 - 2) If formed sheet steel sill support members are used, the structural properties of these members shall match or exceed the structural properties of 4" x 4" x 1/4" angle for single speed entrances, and 5"x 5" x 3/8" angle for two speed entrances.
 9. Struts - Provide 3" x 3" x 1/4" hot rolled steel angle struts.
 - a. If formed sheet steel struts are used, the structural properties of formed struts shall match or exceed the structural properties of 3" x 3"x 1/4" steel angle.
 - b. Extend the struts from top of sill to either the bottom of floor beam or intermediate framing above.
 - c. Bolt struts in place with not less than two (2) bolts at each end.
 - d. Strut clip angles or brackets shall have a thickness not less than the thickness of the supported strut.
 10. Track Support – 3/16-inch-thick steel track support plate shall extend between and be bolted to the vertical steel struts with no less than two (2) bolts at each end.
 11. Track Covers – 16-gauge steel cover plates shall extend the full travel of the doors.
 - a. Covers shall be made in sections for service access to hangers, sheaves, tracks and interlocks.
 - b. The sections above the door opening shall be movable from within the elevator car.
 - c. Cover fastening devices shall be non-removable from the cover.
 12. Fascias – 16-gauge steel fascia plates shall extend at least the full width of the door and be secured at hanger support and sill with oval head machine screws.
 - a. Provide fascia plates where the clearance between the edge of the loading side of the platform and the inside face of the hoistway enclosure exceeds the code allowed clearance.
 13. Toe Guards – Provide 16-gauge steel toe guards to extend 12 inches below any sill not protected by fascia.
 - a. The toe guards shall extend the full width of the door and shall return to the hoistway wall at a 15-degree angle and be firmly fastened.
 14. Dust Covers - Provide 16-gauge steel dust covers to extend 6 inches above any header not protected by fascia.
 - a. The dust covers shall extend to a full width of travel of the doors, return to the hoistway wall at a 15-degree angle and be firmly fastened.
- B. Tracks / Hangers / Closers / Related Equipment
1. Formed or extruded steel landing door hanger tracks shall be provided.

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2. Each landing door panel shall be suspended from a pair of door hanger assemblies that are compatible with the hanger tracks.
 - a. Hanger assemblies shall be directly mounted to the door panel using 3/8" diameter or better hardware.
 - b. Solid steel blocks shall be used where job-site conditions dictate the use of spacers between hanger assemblies and the landing door panel.
 - c. Hanger assemblies shall be adjusted or shimmed so that door panels are suspended in a plumb manner with no more than 3/8" vertical clearance to the cab entrance threshold.
 - d. Upthrust rollers shall be adjusted for minimal operating clearance against the bottom edge of the hanger track.
 - e. Means shall be provided to prevent hangers from jumping the track.
 - f. Blocks shall be provided to prevent rollers from overrunning the end of the track.
 3. Each set of multi-speed side slide landing doors shall be provided with a sill-mounted spring closing mechanism with necessary door panel relating hardware.
 4. In multi-speed door arrangements, provisions shall be made to interlock the individual panels so all panels close should the normal door panel relating means fail.
- C. Interlocks / Unlocking Devices
1. Each set of landing doors shall be provided with a complete electromechanical interlock assembly.
 - a. Each interlock assembly shall consist of:
 - 1) A switch housing with contacts
 - 2) Lock keeper
 - 3) Clutch engagement/release subassembly
 - 4) Associated linkages
 - b. Arrange the lock so that individual leading door panels (side slide) are locked when in the closed position.
 2. Non-typical mounting arrangements for interlocks and/or related mechanisms must receive prior approval from the Consultant.
 3. Each hoistway door interlock assembly shall be provided with an emergency release mechanism utilizing a drop-leaf type access key at all landings served.
 - a. Each hoistway door shall accommodate manufacturers standard lock release key with escutcheon.
 - 1) The key hole shall be fitted with a stainless steel metal ferrule that matches the door finish.
 - 2) Drilling key holes in the field will not be accepted.

2.8 CAR EQUIPMENT / FRAME

- A. Car Frame and Platform
1. The car frame shall be made of steel members, with the required factor of safety.
 2. The car platform shall consist of a steel frame with necessary steel stringers, all securely welded together.
 3. The frame and platform shall be so braced and reinforced that no strain will be transmitted to the elevator car.
 4. Passenger Elevators
 - a. Provide platform with two (2) layers of 3/4" thick marine grade plywood.
 - b. Cover the underside of the car platform with sheet steel.

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- c. The support frame shall carry rubber pads on which the platform shall rest without any connection to the steel frame for sound and vibration isolation.
 - d. Provide extruded nickel silver thresholds having non-slip surface, guide grooves.
 - e. Recess the platform to receive finished flooring as selected by the architect.
 - f. The car frame shall be sized for an 8'-0" overall cab height.
 - g. Design the elevator frames and platforms for a Class A freight loading.
- B. Car Safety
1. Provide a governor actuated mechanical safety device mounted under the car platform and securely bolted to the car sling.
 2. The car safety shall be sized for the capacity and speed noted herein.
 - a. When tripped, the safety mechanism shall engage the rails with sufficient force to stop a fully loaded car with an average rate of retardation within the limits given in A17.1 Safety Code as adopted and/or otherwise modified by the AHJ.
 3. Install a car safety marking plate of corrosion resistant metal and, in addition to the data required by Code, indicate the manufacturer's name and manufacturer's catalog designation number for safety.
 4. Make provisions to release the car safety. In no event shall the safety be released by downward motion of the car. Raising the car to reset the safety shall be allowed.
 5. Provide an electrical safety plank switch that will interrupt the power to the hoist machine and apply the machine brakes when the safety is set.
- C. Top-of-Car Inspection Operating Station
1. An inspection operating station shall be provided on top of the elevator car.
 2. This station shall be installed so that the controls are plainly visible and readily accessible from the hoistway entrance without stepping on the car.
 3. When the station is operational, all operating devices in the car shall be inoperative.
 4. Provide the following control devices and features:
 - a. A push/pull or toggle switch designated "EMERGENCY STOP" shall be arranged so as to prevent the application of power to the hoist motor or machine brake when in the "off" position.
 - b. A toggle switch designated "INSPECTION" and "NORMAL" to activate the top of car Inspection Service Operation.
 - c. Push button designated "Up", "Down" and "Enable" to operate the elevator on Inspection Service (the "Enable" button shall be arranged to operate in conjunction with either the "Up" or "Down" button).
 - d. An indicator light and warning buzzer that are subject to activation under Phase I - Fire Emergency Recall Operation.
- D. Load Weighing Device
1. Provide means to measure the load in the car within an accuracy of $\pm 4\%$ of the elevator capacity.
 2. Provide one of the following types of devices:
 - a. A device consisting of four strain gauge load cells located at each corner of the car platform and supporting a free floating car platform and cab with summing circuits to calculate the actual load under varying conditions of eccentric loading.
 - b. A strain gauge device located on the crosshead, arranged to measure the deflection of the crosshead and thus determine the load in the car.
 - c. A device consisting of four strain gauge load cells, supporting the weight of the elevator machine with summing circuits to calculate the actual load under varying conditions of load.

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- d. A device to measure the tension in the elevator hoist ropes and thus determine the load in the car.
 3. Arrange that the output signal from the load weighing device be connected as an input to the signal and motor control systems to pre-torque of the hoisting machine motors where applicable.
 4. Provide audible and visual signals in connection with the load weighing device when used as an "overload" device.
- E. Car Enclosure Work Light / Receptacle
1. The top and bottom of each car shall be provided with a permanent lighting fixture and 110 volt GFI receptacle.
 2. Light control switches shall be located for easy accessibility from the hoistway entrance.
 3. Where sufficient overhead clearance exists, the car top lighting fixture shall be extended no less than 24" above the crosshead member of the car frame.
 4. Light bulbs shall be guarded so as to prevent breakage or accidental contact.
- F. Emergency Exits / Top
1. Ensure they operate as per code and have proper electrical contacts and mechanical locks on the exterior of the cab enclosure.
 2. The top of car emergency exit shall be so arranged that it can be opened from within the car by means of a keyed spring-return cylinder-type lock having not less than a five-pin or five-disk combination and opened from the top of the car without the use of a key.
 3. No other key to the building shall unlock the emergency exit lock except access switch keys which may be keyed alike.
 - a. Keys shall be assigned in accordance with ASME A17.1 Group 1 Security requirements.
 4. As required, the top emergency exit shall be provided with an electric contact so located as to be inaccessible from the inside of the car. The opening of the electrical contact shall limit the car speed to not more than 150 ft/min (0.76 m/s).
- G. Master Door Power Operator System – VVVF/AC
1. Provide a heavy-duty master door operator on top of the elevator car enclosure for power opening and closing of the cab and hoistway entrance door panels.
 2. The operator may be of the pivot/lever or belted linear drive type.
 3. Operator shall utilize an alternating current motor, controlled by a variable voltage, variable frequency (VVVF) drive and a closed-loop control with programmable operating parameters.
 - a. System may incorporate an encoder feedback to monitor positions with a separate speed sensing device or an encoderless closed-loop VVVF-AC control to monitor motor parameters and vary power applied to compensate for load changes.
 4. The type of system shall be designated as a high speed operator, designed for door panel opening at an average speed of 2.0 feet per second and closing at approximately 1.0 foot per second.
 - a. Reduce the closing speed as required to limit kinetic energy of closing doors to within values permitted by ASME A17.1 as may be adopted and/or modified by the AHJ.
 5. The door shall operate smoothly without a slam or abrupt motion in both the opening and closing cycle directions.

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- a. Provide nudging to limit speed and torque in conjunction with door close signaling/closing and timing devices as permitted by ASME A17.1 as may be adopted and/or modified by the AHJ. Nudging shall be initiated by the signal control system and not from the door protective device.
 6. In case of interruption or failure of electric power from any cause, the door operating mechanism shall be so designed that it shall permit emergency manual operation of both the car and corridor doors only when the elevator is located in the floor landing unlocking zone.
 - a. The hoistway door shall continue to be self-locking and self-closing during emergency operation.
 - b. The door operator and/or car door panel shall be equipped with safety switches and electrical controls to prevent operation of the elevator with the door in the open position as per ASME A17.1 Code Standards.
 - c. Provide zone-lock devices as required by ASME A17.1 as may be adopted and/or otherwise modified by the AHJ.
 7. Construct all door operating levers of heavy steel or reinforced extruded aluminum members.
 8. Belts shall be designed for long life and operate noise free.
 9. All components shall be designed for stress and forces imposed on the related parts, linkages and fixed components during normal and emergency operation functions.
 - a. All pivot points, pulleys and motors shall have either ball or roller-type bearings, oilite bronze bushings or other non-metallic bushings of ample size.
 10. Provide operating data / data tag permanently attached to the operator as required by applicable code and standards.
- H. Door Reopening Device / "3D"
1. Provide a combination infrared curtain and 3D door protection system.
 2. The door shall be prevented from closing and will reopen when closing if any one of the curtain light rays is interrupted or should an object enter the 3D detection zone.
 3. The door shall start to close when the protection system is free of any obstruction.
 4. The infrared curtain and 3D zone protective system shall provide:
 - a. Protective curtain field not less than 71" above the sill.
 - b. 3D protective zone field not less than 61" above the sill.
 - c. Accurately positioned infrared lights to conform to the requirements of the applicable handicapped code.
 - d. Modular design to permit on board test operation and replacement of all circuit boards without removing the complete unit.
 - e. Self-contained, selectable 3D zone timeout feature to allow for closing at nudging speed with audible signal.
 - f. Automatic turning-off of the 3D zone in the event of three (3) consecutive 3D triggers.
 - 1) Light curtain shall continue to operate after 3D system timeout.
 - g. Selectable control of the 3D zone operation on an "always-on" or "as doors close" basis.
 - h. Controls to shut down the elevator when the unit fails to operate properly.

2.9 FINISH / MATERIALS / SIGNAGE

- A. Material, Finishes and Painting
 1. General

- a. Cold-rolled Sheet Steel Sections: ASTM A366, commercial steel, Type B
- b. Rolled Steel Floor Plate: ASTM A786
- c. Steel Supports and Reinforcement: ASTM A36
- d. Aluminum-alloy Rolled Tread Plate: ASTM B632
- e. Aluminum Plate: ASTM B209
- f. Stainless Steel: ASTM A167 Type 302, 304 or 316
- g. Stainless Steel Bars and Shapes: ASTM A276
- h. Stainless Steel Tubes: ASTM A269
- i. Aluminum Extrusions: ASTM B221
- j. Nickel Silver Extrusions: ASTM B155
- k. Bronze Sheet: ASTM B36(36M) alloy UNS No. C2800 (Muntz Metal)
- l. Structural Tubing: ASTM A500
- m. Bolts, Nuts and Washers: ASTM A325 and A490
- n. Laminated / Safety Tempered Glass: ANSI Z97.1

2. Finishes

- a. Stainless Steel
 - 1) Satin Finish: No. 4 satin, long grain
- b. Sheet Steel:
 - 1) Shop Prime: Factory-applied baked on coat of mineral filler and primer.
 - 2) Finish Paint: Two (2) coats of low sheen baked enamel, color as selected by the Architect.
 - 3) Steel Equipment: Two (2) coats of manufacturer's standard rust-inhibiting paint to exposed ferrous metal surfaces in both the hoistway and pit that do not have galvanized, anodized, baked enamel, or special architectural finishes.

3. Painting

- a. Apply two (2) coats of clear lacquer to bronze or similar non-ferrous materials to prevent tarnishing during a period of not less than twelve (12) months after initial acceptance by the Owner or Agent.
- b. Identify all equipment including buffers, crosshead, safety plank, machine, controller, drive, governor, disconnect switch, etc., by 4" high numerals which shall contrast with the background to which it is applied. The identification shall be either decalcomania or stencil type.
- c. Paint or provide decal-type floor designation not less than 6 inches high on hoistway doors (hoistway side), fascias and/or walls as required by A17.1 as may be adopted and/or modified by the AHJ. The color of paint used shall contrast with the color of the surface to which it is applied.

B. Hoistway Entrances Finish and Design

1. Entrance Frames:

- a. Provide baked enamel bolted type frames having matching end caps and a two (2) inch wide square profile.
 - 1) Finish color shall be selected by the Architect from the manufacturer's standard catalog.

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2. Door Panels:
 - a. Provide baked enamel
 - 1) Finish color shall be selected by the Architect from the manufacturer's standard catalog.
 3. Entrance Sills:
 - a. At all floors provide nickel silver
- C. Designation and Data Plates, Labeling and Signage.
1. Provide an elevator identification plate on or adjacent to each entrance frame at the designated main recall floor.
 - a. Car designations and Braille shall be 2" high, 0.03" raised and stud mounted.
 2. Provide floor designation plates at each elevator entrance, on both sides of the jamb at a height of 60 inches to center line of plate.
 - a. Floor number designations and Braille shall be 2" high, 0.03" raised and stud mounted.
 3. Identify the elevator with the 3" high "star of life" international symbol on both sides of the jamb at the designated main recall floor.
 4. Provide raised designations and Braille markings to the left of the car call and control buttons of the car operating panel(s).
 - a. Designations shall be a minimum of 5/8" high, 0.03" raised and stud mounted.
 5. Provide the elevator with data and marking plates, labels, signages and refuge space markings complying with A17.1 Elevator Safety Code as may be adopted and/or otherwise modified by the AHJ.

2.10 FIXTURES / SIGNAL EQUIPMENT

- A. General - Design and Finish
1. The design and location of the hall and car operating and signaling fixtures shall comply with the ADAAG.
 2. The operating fixtures shall be selected from the manufacturer's premium line of fixtures.
 3. The layout of the fixtures including all associated signage and engraving shall be as approved by the Architect.
 4. The buttons shall be as follows:
 - a. Bronze No. 4 finish convex type with LED illuminating collar call registered light.
 5. The faceplates shall be as follows:
 - a. Bronze No. 4 finish faceplate.
 6. Mount passenger elevator fixtures with tamperproof screws. The screw and key switch cylinder finishes shall match faceplate finish.
 7. Where key-operated switch and or key operated cylinder locks are furnished in conjunction with any component of the installation, four keys for each individual switch or lock shall be furnished, stamped or permanently tagged to indicate function.
 8. All code mandated instructions, directives, and "in case of fire, must use stairs..." signage shall be engraved and filled with epoxy directly on the car station.
 9. Fire Department key switch and MA EMT switch shall be integrated in the main lobby station.
 10. Emergency power indicator shall be integrated into the main lobby station.

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- B. Main Car Operating Panel
1. Car operating panel shall be incorporated in the swing-front return of the elevator cab.
 - a. Coordination with car front manufacturer shall be the responsibility of the Elevator Contractor.
 2. The push buttons shall become individually illuminated as they are pressed and shall extinguish as the calls are answered.
 3. The operating panel shall include:
 - a. A call button for each floor served, located not more than 48" above the cab floor.
 - b. "Door open" / "Door close" / "Door Hold" buttons.
 - c. "Alarm" button interfaced with emergency alarm. The alarm button shall illuminate when pressed.
 - d. "Emergency Stop" switch per local law located at 35" above the cab floor.
 - e. Self-dialing, hands-free telephone with call acknowledging feature and A.D.A. design provisions.
 - f. Three (3) position firefighter key operated switch, call cancel button and illuminated visual/audible signal system with mandated signage engraved per ASME A 17.1 Standards as modified by the AHJ.
 - g. Flush grey lexan lens for mounting of card reader.
 4. Locked Firemen's Service cabinet, keyed in accordance with local Code, containing required devices and signals in accordance with ASME A17.1 Standards.
 - a. Automatic opening of the locked cabinet door may be provided with signals initiated by the fire detection and alarm system where approved by the Authority Having Jurisdiction.
 5. Provide a locked service cabinet flush mounted and containing the key switches required to operate and maintain the elevator, including, but not limited to:
 - a. Independent service switch
 - b. Light switch.
 - c. Two Speed Fan switch.
 - d. G. F. I. duplex receptacle.
 - e. Emergency light test button and indicator.
 - f. Inspection Service Operation key switch.
 6. Car operating panel shall incorporate:
 - a. Black-filled engraved unit I.D. number and the rated passenger load capacity in pounds.
 7. Post Inspection Certificate in a frame with a matching finish on the main car station.
- C. Car Position Indicator
1. The position of the car in the hoistway shall be indicated by the illumination of the position indicator numeral corresponding to the floor at which the car has stopped or is passing.
 - a. Provide 2" high, 10-segment LED type position indicator with direction arrows, integral with the car operating panel.
 - b. Provide Lexan cover lens with hidden support frame behind fixture plate to protect the indicator readout.
 - c. Provide audible floor passing signal per ADA standards where not provided by the elevator signal control.
 - d. Flush mount fixture with cover to match selected car front or car operating panel finish as directed by the Owner.

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- D. Car Direction Lantern
1. Provide a car riding lantern with visual and audible signal in the edge of the strike and return post.
 2. The lens shall project a minimum of 1/4" and shall be of solid Plexiglas.
 3. Use tamperproof screws with surface mount faceplate.
 4. Car lantern shall indicate the direction of travel when doors are 3/4 open.
 5. The unit shall sound once for the "up" direction and twice for the "down" direction.
 - a. Provide an electronic chime with adjustable sound volume.
- E. Voice Annunciator
1. Provide a voice annunciator in the elevator.
 2. The device features shall comply with the requirements of ADAAG and A117.1 where applicable.
 3. Coordinate size, shape and design with Designer and other trades.
 4. The system shall include, but not limited to:
 - a. Solid state digital speech annunciator
 - b. A recording feature for customized messages
 - c. Playback option
 - d. Built-in voice amplifier
 - e. Master volume control
 - f. Audible indication for selected floor, floor status or position, direction of travel, floor stop and nudging.
 5. Locate all associated equipment in a single, clearly labeled enclosure located either in the machine room and/or on car top.
- F. MA Medical Emergency Service Car and Main Hall Station Operating Devices
1. Provide MA medical emergency key switch and indicator in accordance with 524 CMR requirements at the main hall push button station and car operating panel.
 2. The car control key switch shall be of the two (2) position type with key removal in the "OFF" position only.
 3. All required signage shall be engraved and filled with epoxy.
 4. The medical emergency device at the main hall station shall be integrated with the main station and not provided as a separate panel.
- G. Corridor Push Button Stations / Riser
1. A riser of push button signal fixtures shall be provided on all floors.
 2. Each signal fixture shall consist of the following:
 - a. A flush-mounted faceplate.
 - b. Illuminating tamper-resistant push buttons measuring 3/4" at their smallest dimension as selected by the Owner.
 - c. A recessed mounting box, electrical conduit and wiring.
 3. Intermediate landings shall be provided with fixtures containing two (2) push buttons while terminal landings shall be provided with fixtures containing a single push button.
 4. Include firefighter key switch, MA EMT provisions, communication failure device, and emergency power provisions in the main lobby level station or other designated recall landing.
 5. Push button signal fixtures shall be installed at a centerline height of 42" above the floor and shall be installed both plumb and flush to the finished wall.
 - a. Standardize the final distance on all floors.

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6. Fixture faceplates shall be installed adjacent to the entrance frame on front wall.
 7. Design and location of fixtures shall be in compliance with 521 CMR.
- H. Hoistway Access Switch
1. Install a cylindrical type keyed switch at top terminal in order to permit the car to be moved at slow speed with the doors open to allow authorized persons to obtain access to the top of the car.
 2. Where there is no separate pit access door, a similar switch shall be installed at the lowest landing in order to permit the car to be moved away from the landing with the doors open in order to gain access to the pit.
 3. Locate the switch in the terminal floor entrance jambs with a surface mounted faceplate at a height of 78" above the finished floor.
 4. This switch is to be of the continuous pressure spring-return type and shall be operated by a cylinder type lock having not less than a five-pin or five-disc combination with the key removable only in the "OFF" position.
 - a. The lock shall not be operable by any key which operates locks or devices used for other purposes in the building and shall be available to and used only by inspectors, maintenance men and repairmen in accordance with A17.1 applicable Security Group.

2.11 CAR ENCLOSURES

- A. Passenger Elevator SE1
1. Wall Panels: $\frac{3}{4}$ " thick fire-retardant plywood with all surfaces finished in stainless steel No. 4 finish.
 - a. The panels shall be constructed as the removable type.
 - b. The panels shall be selected from the manufacture's standard finishes and as approved by the Architect.
 2. Front Return Panels and Transom: Provide stainless steel No. 4 finish.
 3. Cab doors: Provide stainless steel No. 4 finish.
 4. Canopy: Paint canopy with a coat of primer and one (1) coat of enamel paint.
 5. Ceiling: Provide a suspended $\frac{3}{4}$ " thick retardant plywood or particle board ceiling with all surfaces finished in stainless steel No. 4 finish.
 6. Handrails: Provide a double row of flat $\frac{1}{2}$ " by 4" stainless steel No. 4 finish handrails at the side and rear walls.
 - a. Handrails shall be designed to be removable from inside the cab.
 - b. Handrails shall be mounted at a height of 12" and 32" above the cab floor.
 7. Lighting: Provide fully recessed LED down light fixtures with aluminum alzak reflector.
 - a. A light fixture shall be provided in each ceiling panel for even illumination.
 8. Base: Provide a 4" high stainless steel No. 4 finish base.
 9. Flooring: Recess and prepare sub-flooring to accept the finish flooring to be installed by Others.
 10. Provide concealed vent slots above the side and rear wall base for proper ventilation.
 11. Provide a sound isolated two (2) speed operating fan.
 12. Provide one (1) set of protective fire resistant cotton pads to be mounted on the interior cab walls.
 - a. Pads shall be mounted by way of stainless steel buttons.
- B. Elevator Cab / General Design Requirements

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1. Materials:
 - a. Particleboard: Premium grade, AWI, Section 200, fire retardant treated, equal to Duraflake FR.
 2. Steel Shell: 14-gauge furniture steel reinforced and designed to accept finished wall panels. Finish shell panels with one (1) coat of rust inhibitive primer and two (2) coats of enamel paint in accordance with Section 09900. Apply 1/8" thick, rubberized sound deadening material to the hoistway side of the shell.
 - a. All panels shall have minimum radii. Apply sealant beads to panel joints before bolting together with lock washers.
 3. Canopy: Canopy construction methods shall match the shell walls. Use 12-gauge furniture sheet steel and adequately support canopy to comply with the loading requirements of the Code.
 - a. Provide necessary cutouts for the installation of fan and top emergency exit. Arrange exit panel to swing up using a heavy duty piano hinge.
 - b. The exit panel shall have dual locks, necessary stops and a handle.
 - c. When in the locked position, the panel shall be flush with the interior face of the canopy with hairline joints.
 4. Base: Recess and prepare the shell to accept the base.
 - a. Provide concealed vent slots above side and rear wall base for proper ventilation. Arrange and size vent slots for quiet operation without any whistling. Use 16-gauge baffles to protect the hoistway side of the vent slots.
 - b. The elevator cab shop drawings shall include elevator vent calculations and number, location and size of top and bottom vent holes.
 5. Flooring: Recess and prepare sub-flooring to accept the finished flooring.
 6. Front Return Panels, Entrance Posts and Transom: Use 16-gauge furniture sheet steel with proper reinforcing to prevent oil canning.
 - a. Swing front return panels shall have required cutouts for the car call buttons, keyed switches, indicators, cabinets and the specified special control and signaling devices.
 - 1) Provide concealed full height stainless steel piano hinges of sufficient strength to support the panel, without sagging, in the open position.
 - 2) The concealed locks shall secure the panel at two (2) points with linkage that shall be free of vibration and noise when in the locked position.
 - 3) When locked in the closed position, the front return panel shall be in true alignment with the transom and base.
 - 4) Lock release holes shall be not more than 1/4" diameter and be located at the return side jamb of the panel.
 - 5) Engrave the elevator identification number, capacity in pounds, firefighter instructions, and other code mandated instructions and caution signs directly in the front return panel.
 - 6) Applied panels shall be considered unacceptable.
 - b. Transom shall be 16-gauge and be reinforced and constructed the same as the front return panels.
 - c. Construct entrance posts for the passenger elevator from 12-gauge sheet steel and reinforce to maintain vertical alignment with the adjacent panels.
 7. Cab Doors: Standard 1" thick, 14-gauge hollow metal flush construction, reinforced for power operation and insulated for sound deadening. Paint hatch side of doors black and face cab side with 16-gauge sheet steel in selected material and finish.
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- a. The door panels shall have no binder angles. All welds shall be continuous, ground smooth and invisible.
 - b. Drill and reinforce doors for installation of door operator hardware, door protective device, door gibs, etc.
8. Ceiling: Construction techniques for wall panels shall apply to ceiling panel construction. Locate top emergency exit inconspicuously. Construct and mount the exit panel to prevent light leakage around the perimeter of panel.
 9. Ventilation: The ventilation system of the exhaust type shall be provided in each elevator.
 - a. The system shall include a blower driven by a direct connected motor and mounted on top of car with isolation to effectively prevent transmission of vibration to the car structure. The blower shall have not less than two (2) operating speeds. The ventilation system shall be sized to provide one (1) air change per minute at low speed and 1.5 air changes per minute at high speed. The unit design and installation shall be such that the maximum noise level, when operating at high speed, shall not exceed 55 dBA approximately three feet above the car floor. A three-position switch to control the blower shall be provided in the car station.
 10. Lighting: Arrange lighting fixtures and ceiling assembly to provide even illumination without hot spots and shadows.
 - a. Design and configure lighting system to facilitate maintenance of the fixtures.
 - b. Provide LED type lighting.
 11. Handrails: All attachment hardware shall match the selected handrail and shall permit handrail removal from within the cab.
 - a. Provide a minimum of 10-gauge plate at the hatch side of the shell, aligned with the handrail attachment points, to assure secure handrail mounting.
 - b. Design handrail attachment system to support the weight of a person (250 pounds) sitting on it without any deflection and damage to the handrail, cab panel and the shell.
 12. Protective Pads and Pad buttons: Provide pad buttons at locations as directed by the Architect. Protective pads shall cover the front return panels, and the side and rear walls. Provide cutouts in pads for access to the cab operating and signaling devices. Pads shall be fire-resistant canvas with two (2) layers of cotton batting padding.
 - a. Identify each pad by elevator number and wall location.
 13. Accessories: Construct elevator cab to accommodate the door operator, hangers, interlocks and all accessory equipment provided under other sections of these specifications.
 14. All cab materials shall conform to the code prescribed flame spread rating and smoke development requirements.
- C. Cab Fabrication and Installation
1. Maintain accurate relation of planes and angles with hairline fit of contacting panels and/or surfaces.
 2. Any shadow gaps (reveals) between panels shall be consistent and uniform.
 3. Maximum exposed edge radius at corner bends shall be 1/16". There shall be no visible grain difference at the bends.
 4. Form the work to the required shapes and sizes with smooth and even curves, lines and angles. Provide necessary brackets, spacers and blocking material for assembly of the cab.

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5. Interior cab surfaces shall be flat and free of bow or oil canning. The maximum overall deviation between the low and high points of 24" x 24" panel section shall not exceed 1/32".
 6. Make weights of connections and accessories adequate to safely sustain and withstand stresses to which they will be subjected.
 7. All steel work except stainless steel and bronze materials shall be painted with an approved coat of primer and one (1) coat of baked enamel paint.
 8. Cab Finish Warranty Enhancement
 - a. Contractor shall be responsible for engineering and installing interior cab finishes in a manner that will withstand all code mandated inspections and test procedures. Failure of finishes during testing shall be repaired by the contractor without expense to the owner. Any objections or qualifications to material selection or design shall be identified during the engineering of the cab interior drawings for review by the owner.

2.12 EMERGENCY LIGHTING / COMMUNICATIONS / SIGNALING

- A. Battery Back Up Emergency Lighting Fixture and Alarm
 1. Provide a self-powered emergency light unit.
 - a. Arrange two (2) of the cab light fixtures to operate as the emergency light system.
 - b. Where cab lighting is utilized for emergency lighting, Contractor shall coordinate the battery back-up equipment so that it is compatible with the type of cab lighting specified by the Owner or Architect.
 2. Provide a car-mounted battery unit including solid-state charger and testing means enclosed in common metal container.
 - a. The battery shall be rechargeable nickel cadmium with a ten (10) year minimum life expectancy. Mount the power pack on the top of the car.
 - b. Provide a 6" diameter alarm bell mounted directly to the battery/charger unit and connected to sound when any alarm push button or stop switch in the car enclosure is operated.
 - c. The bell shall be configured to operate from power supplied by the building emergency power generator. The bell shall produce a sound output of between 80-90 dBa (measured from a distance of 10') mounted on top of the elevator car.
 - 1) Activation of this bell shall be controlled by the stop switch and alarm button in the car operating station
 - 2) The alarm button shall illuminate when pressed.
 3. Where required by Code for the specific application, the unit shall provide mechanical ventilation for at least one (1) hour.
 4. The operation shall be completely automatic upon failure of normal power supply.
 5. Unit shall be connected to normal power supply for car lights and arranged to be energized at all times, so it automatically recharges battery after use.

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- B. Emergency Voice Communication / Telephone
1. A hands-free emergency voice communication system shall be furnished in each car mounted as an integral part of the car operating panel.
 - a. Necessary wires shall be included in the car traveling cable and shall consist of a minimum of one shielded pair of 20AWG conductors.
 - b. 120V power shall be provided to power the hands-free device.
 2. The telephone shall be equipped with an auto-dialer and illuminating indicator which shall illuminate when a call has been placed and begin to flash when the call has been answered.
 - a. Engraving shall be provided next to the indicator which says, "When lit help is on the way".
 3. In addition to the standard "Alarm" button, a separate activation button shall be provided on the car operating panel to initiate the emergency telephone and place a call.
 - a. The telephone must not shut off if the activating button is pushed more than once.
 - b. The telephone shall transmit a pre-recorded location message only when requested by the operator and be provided with an adjustable call time which can be extended on demand by the operator.
 - c. Once two-way communication has been established, voice prompts shall be provided which instruct the operator on how to activate these functions as well as alerting the operator when a call is being attempted from another elevator in the building.
 4. The system shall be capable of serving as the audio output for an external voice annunciation system.
 - a. Conversation levels shall measure 60 dbA or higher and measure 10 dbA above ambient noise levels.
 - b. Each device shall be provided with a self-diagnostic capability in order to automatically alert building personnel should an operational problem be detected.
 5. The phone shall be able to:
 - a. Receive incoming calls from any On-Site Rescue Station (when provided or required).
 - b. Receive incoming calls from other off-site locations via the public telephone system.
 - c. Acknowledge incoming calls and automatically establishing hands-free two way communications.
 - 1) If no On-Site Rescue Station is provided, each hands-free device shall have built in line consolidation which will allow up to six (6) elevators to be called individually from outside the building over a single telephone line and up to 80 elevators if an On-Site Rescue Station is provided.
 6. The emergency elevator communication system shall require a maximum of one (1) telephone line.
 - a. The system must provide line sharing capability to eliminate the need for a dedicated telephone line.
 - b. The line sharing function must ensure that the emergency telephones always receive dialing priority even if the line is in use and that the emergency telephones can be called into from an off-site location.
 7. The system shall provide its own four-hour backup power supply in case of a loss of regular AC power.
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8. The system must provide capability for building personnel to call into the elevator and determine the charge state of any backup batteries provided for the emergency telephones.
 9. Pushing the activation button in any of the elevator car stations will cause any on-site Rescue Station (where provided or required) or security telephone to ring.
 - a. If the on-site call is not picked up within thirty (30) seconds, the call will be automatically forwarded to a twenty-four (24) hour off-site monitoring service.
 - b. The arrangements and costs of the off-site monitoring and telephone line shall be by others.
 10. All electrical work shall conform to Division 16 requirements.

2.13 SCAFFOLDS AND STAGING

- A. General: Filed Subcontractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and herein.
 1. Scaffolding and staging required for use by this Filed Subcontractor pursuant to requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Filed Sub-Trade requiring such scaffolding.
 2. Each Filed Subcontractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Filed Subcontractor.

2.14 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Filed Subcontractor shall be furnished, installed, operated and maintained in safe conditions by this Filed Subcontractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Inspection
 1. Study the Contract Documents with regard to the work as specified and required so as to ensure its completeness.
 2. Examine surface and conditions to which this work is to be attached or applied and notify the Owner in writing if conditions or surfaces are detrimental to the proper and expeditious installation of the work. Starting the work shall imply acceptance of the surfaces and conditions to perform the work as specified.
 3. Verify, by measurements at the job site, dimensions affecting the work. Bring field dimensions which are at variance with those on the accepted shop drawings to the attention of the Owner. Obtain the decision regarding corrective measures before the start of fabrication of items affected.

4. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

3.2 INSTALLATION

A. Installation

1. Install the elevator using skilled personnel in strict accordance with the final accepted shop drawings and other submittals.
2. Comply with the code, manufacturer's instructions and recommendations.
3. Coordinate work with the work of other building functions for proper time and sequence to avoid delays and to ensure right-of-way of system. Use lines and levels to ensure dimensional coordination of the work.
4. Accurately and rigidly secure supporting elements within the shaftways to the encountered construction within the tolerance established.
5. Provide and install motor, switch, control, safety and maintenance and operating devices in strict accordance with the submitted wiring diagrams and applicable codes and regulations having jurisdiction.
6. Ensure sill-to-sill running clearances do not exceed 1 ¼" at all landings served.
7. Erect guide rails plumb and parallel with a tolerance of 1/8" (plus or minus 1/16").
8. Install rails so joints do not interfere with brackets.
9. Set entrance plumb in hoistway and in alignment with guide rails prior to erection of the front walls.
10. Arrange door tracks and sheaves so that no metal-to-metal contact exists.
11. Reinforce hoistway fascias to allow not more than 1/2" of deflection.
12. Install elevator cab enclosure on platform plumb and align cab entrance with hoistway entrances.
13. Sound isolate cab enclosure from car structure. Allow no direct rigid connections between enclosure and car structure and between platform and car structure.
14. Isolate cab fan from canopy to minimize vibration and noise.
15. Remove oil, dirt and impurities and give a factory coat of rust inhibitive paint to all exposed surfaces of struts, hanger supports, covers, fascias, toe guards, dust covers and other ferrous metal.
16. Prehang traveling cables for at least twenty-four (24) hours with ends suitably weighted to eliminate twisting after installation.
17. After installation, touch up in the field, surfaces of shop primed elements which have become scratched or damaged.
18. Lubricate operating parts of system as recommended by the manufacturer.

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing

1. Upon completion of each work phase or individual elevator specified herein, the Contractor shall, at its own expense, arrange and assist with inspection and testing as may be required by the A.H.J. in order to secure a Certificate of Operation.

B. Substantial Completion

1. The work shall be deemed "Substantially Complete" for an individual unit or group of units when, in the opinion of the Consultant, the unit is complete, such that there are no material and substantial variations from the Contract Documents, and the unit is fit for its intended purpose.

2. Governing authority testing shall be completed and approved in conjunction with inspection for operation of the unit; a certificate of operation or other required documentation issued; and remaining items mandated for final acceptance completion are limited to minor punch list work not incorporating any life safety deficiencies.
3. The issuance of a substantial completion notification shall not relieve the Contractor from its obligations hereunder to complete the work.
4. Final completion cannot be achieved until all deliverables, including but not limited to training, spare parts, manuals, and other documentation requirements, have been completed.

3.4 PROTECTION / CLEANING

A. Protection and Cleaning

1. Adequately protect surfaces against accumulation of paint, mortar, mastic and disfiguration or discoloration and damage during shipment and installation.
2. Upon completion, remove protection from finished surfaces and thoroughly clean and polish surfaces with due regard to the type of material. Work shall be free from discoloration, scratches, dents and other surface defects.
3. The finished installation shall be free of defects.
4. Before final completion and acceptance, repair and/or replace defective work, to the satisfaction of the Owner, at no additional cost.
5. Remove tools, equipment and surplus materials from the site.

3.5 DEMONSTRATION

A. Performance and Operating Requirements

1. Passenger elevator shall be adjusted to meet the following performance requirements:
 - a. Speed: within $\pm 3\%$ in both directions of travel under any loading condition.
 - b. Leveling: within $\pm 1/4"$ as measured between the car entrance threshold and the landing sill on any given floor under any loading condition.
 - c. Typical Floor-to-Floor Time: (Recorded from the doors start to close on one floor until they are 3/4 open at the next floor) under various loading conditions.
Passenger Elevator 11.0 – 12.0 seconds.
 - d. Door Operating Times

Door Type	Opening	Closing
4'-0" side opening	3.0 – 3.5 sec.	3.5 – 4.0 sec.
e. Door dwell time for hall calls:	4.0 sec with Advance lantern signals	
f. Door dwell time for hall calls:	5.0 sec without Advance lantern signals	
g. Door dwell time for car calls:	3.0 seconds	
h. Reduced non-interference dwell time:	1.0 seconds.	

2. Maintain the following ride quality requirements for the passenger elevator:
 - a. Noise levels inside the car shall not exceed the following:
 - 1) Car at rest with doors closed and fan off - 40 dba.
 - 2) Car at rest with doors closed, fan running - 55 dba.
 - 3) Car running at high speed, fan off - 50 dba.
 - 4) Door in operation - 60 dba.

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- b. Vertical and horizontal accelerations shall not exceed 20 milli-g.
 - 1) The accelerometer used for this testing shall be capable of measuring and recording acceleration to nearest 0.01 m/s² (1 milli-g) in the range of 0-2 m/s² over a frequency range from 0-80 Hz with ISO 8041 filter weights applied. Accelerometer should provide contact with the floor similar to foot pressure, 60 kPA (8.7psi).
 - c. The amplitude of acceleration and deceleration shall not exceed 2.6 - 2.8 ft./sec² for geared and MRL traction, and 3.5 - 4 ft./sec² for gearless traction elevators.
 - d. The maximum jerk rate shall be 1.5 to 2.0 times the acceleration and deceleration.
 - e. The maximum velocity which the elevator achieves in either direction of travel while operating under load conditions that vary between empty car and full rated load shall be within $\pm 3\%$ of the rated speed.
- B. Acceptance Testing
- 1. Comply with the requirements of Division 01.
 - 2. The Contractor shall provide at least five (5) days prior written notice to the Owner and Consultant regarding the exact date on which work specified in the Contract Documents will reach completion on any single unit of vertical transportation equipment.
 - 3. In addition to conducting whatever testing procedures may be required by local inspecting authorities in order to gain approval of the completed work, and before seeking approval of said work by the Owner, the Contractor shall perform certain other tests in the presence of the Consultant.
 - 4. The Contractor shall provide test instruments, test weights, and qualified field labor as required to safely operate the unit under load conditions that vary from empty to full rated load and, in so doing, to successfully demonstrate compliance with applicable performance standards set forth in the project specifications with regard to:
 - a. Operation of safety devices.
 - b. Floor leveling accuracy.
 - c. Door opening/closing and dwell times.
 - d. Ride quality inside the elevator car.
 - e. Communication system.
 - 5. The Contractor shall provide test instruments and qualified field labor as required to successfully demonstrate:
 - a. Simulated and actual emergency power operation
 - b. Firefighter and independent service operations
 - c. Restricted access security features and card reader controls

END OF SECTION

Section 210000
FIRE PROTECTION

(Filed Sub-Bid Required)

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END OF INDEX

Section 21 00 00
FIRE PROTECTION

(TRADE CONTRACT REQUIRED AS PART OF SECTION 21 00 00)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.
- C. Trade Contract Requirements: As provided under Section 21 00 00 – FIRE PROTECTION TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 21 00 00.

1.2 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, services and accessories necessary to Design, Furnish and Install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein. The Design shall conform to the documents and shall be subject to approval by the Architect.
- B. Without limiting the generality thereof, the work to be performed under this Section includes:
 - 1. 8" underground Fire Water Service connecting to water loop in the property as shown on the civil drawing C6.1.
 - 2. A hydraulically designed combination automatic sprinkler/standpipe system to provide 100% protection for the new and existing building as noted on the Drawings FP001, FP101A, FP101B, FP101C, FP101D, FP102A, FP102B, FP102C, FP102D, FP103A, FP103B, FP103C and FP104. Refer to Fire Protection Criteria on the Drawings. Prepare Working Drawings for approval of the Architect, the local authority having jurisdiction, and the owner's insurance company under stamp of an independent Massachusetts Registered Professional Fire Protection Engineer.
 - 3. Hydrant flow test
 - 4. Backflow Control Device
 - 5. Fire Department Connections.
 - 6. Pipe and Fittings
 - 7. Valves
 - 8. Hangers

9. Sprinkler Heads
10. Furnishing and installation of Supervisory Switches and Controls
11. Systems Identification
12. Flushing and Testing of the interior and exterior system as provided herein.
13. Drilling, Coring, Cutting & Patching of holes and openings (where the largest dimension thereof does not exceed 12 inches), for Fire Protection Piping and Equipment. All such holes require sleeves.
14. Scaffolding, Rigging, and Staging required for all Fire Protection Work. Comply with Division 1 requirements.
15. Provide pipe support Restraints for all Fire Protection Systems conforming to the requirements of NFPA 13.
16. Furnishing of Access Panels
17. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
18. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch through the Local Fire Department where work is being performed and until it is completed.
19. It shall be the responsibility of this division 210000 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 210000 and the Testing requirements shall be in addition to those tests and requirements outlined in section 019113 & 21 08 00 and required to fulfill section 019113 & 21 08 00 commissioning obligations.

1.3 RELATED WORK

- A. The following items of work related to the Fire Protection Work are included under other Sections of the Specifications:
 1. Cutting & Patching beyond 1.2B.13 above: SECTION 010450 - CUTTING AND PATCHING.
 2. Installation of Access Panels: Respective finish section.
 3. Excavation and Backfill: DIVISION 31
 4. Finish Painting: SECTION 099000: PAINTING
 5. Wiring for Supervisory Switches, Electrical Alarm, and Flow Switches, and Power Wiring: SECTION 260000 - ELECTRICAL
 6. Temporary Facilities: SECTION 015000 - TEMPORARY FACILITIES
 7. Installation of Hood Suppression System – SECTION 114000 FOOD SERVICE EQUIPMENT
 8. Fire Protection Commissioning – Section 21 08 00

1.4 CODES, ORDINANCES, AND PERMITS

- A. Perform all work in accordance with the following Codes:
 - 1. 780 CMR: The State Building Code.
 - 2. 527 CMR: The Fire Prevention Regulations.
 - 3. NFPA-13-2013, NFPA-14-2013, NFPA-24-2010, NFPA-241-2013, and Owner's insurance company requirements.
 - 4. All applicable Local, State, and Federal Codes, Statutes, or Regulations.
 - 5. City of Framingham Fire Department.
 - 6. City of Framingham Building Department.
- B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.

1.5 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarities thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.
- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this contractor shall provide that material, installation, or work which is of the higher standard.
- D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the contractor has failed to notify the Designer of the situation in accordance with the paragraph above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the paragraph above, where the contractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.6 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they

show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.

- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.
- C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.
- D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.7 RECORD DRAWINGS

- A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.
- B. The General Contractor will provide two sets of black or blue line on white Drawings to the Fire Protection Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.
- C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.
- D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.
- E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.
- F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.
- G. All costs related to the foregoing requirements shall be paid by the Fire Protection Subcontractor.

1.8 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide operating instructions to the owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals in three-ring, loose-leaf binders, containing the following:
1. Complete Shop Drawings of all equipment.
 2. Operation description of all systems.
 3. Names, addresses, and telephone numbers of all suppliers of the system.
 4. Preventive maintenance instructions for all systems.
 5. Spare parts list of all system components.
 6. Valve tag chart noting location of any and all valves controlling the fire protection systems including main control, main drain, auxiliary drain, drum drip, inspectors test connections and any low point drains connected to these systems.
- B. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

1.9 SHOP DRAWINGS AND MATERIAL SCHEDULES

- A. Refer to SECTION 013300 - SUBMITTALS for substitution of equipment and submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Fire Protection Subcontractor.
- B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Subcontractor. The Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.
- C. Submit Shop Drawings for the following materials and equipment.
1. Coordinated Working Drawings and hydraulic calculations including size, type, length, temperature rating of sprinkler heads, piping and the like. Indicate flow test results, design criteria, hydraulic reference points, diffuser and light locations.
 2. Access Panels and Covers
 3. Sprinkler Heads
 4. Hangers and Restraints
 5. Pipe, Fittings, and Appurtenances
 6. Systems Identification
 7. Valves
 8. Fire Department Connection

9. Cross Connection Devices

1.10 COORDINATION DRAWINGS

- A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces.
- B. Coordination Drawings are for the Contractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 of these Contract Documents.

1.11 GUARANTEE

- A. Guarantee all work under this Section free from defects in workmanship or materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract.
- B. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment by others. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.12 DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make a complete working system ready for use.
- B. The Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- C. Refer to the Architectural, Structural, and Other Mechanical and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed drawings of the construction proper. All measurements must be taken at the building.

1.13 SYSTEM DESCRIPTION

- A. The building shall be 100% sprinklered with an automatic combination standpipe/sprinkler system. The system shall be designed in accordance with NFPA-13-2013 and NFPA 14-2013.

- B. Building is to be 100% sprinklered including all closets regardless of size, all Electric rooms, and all Emergency Electrical Rooms. The elevator shaft and elevator machine rooms are not sprinklered.
- C. Refer to Fire Protection Criteria on the Drawings. Conform to the zoning shown on the plans.
- D. Locations of sprinkler heads are shown in some of the areas to be sprinklered only to establish the patterns and design intent. Major equipment and runs of piping may also be shown. Refer to reflected ceiling plan for location of all sprinkler heads. All sprinkler heads are to be installed dead center of tile.
- E. The documents require that the building be covered 100%. This includes all closets, combustibile concealed spaces, and other areas as required under NFPA-13-2013. These areas are to be included in the Sub-contractor's bid whether or not the heads are shown on the sprinkler plans.

1.14 ALARM FACILITIES

- A. Furnish and install all Supervisory Switches, Flow Switches, Pressure Switches, and other Alarm Devices. Install all such devices on the piping and coordinate with the Electrical Subcontractor who shall wire all such devices to the Fire Alarm System. Every shutoff valve installed on this project shall have a supervisory trouble switch wired to the Fire Alarm Panel.

1.15 PIPE MARKER IDENTIFICATION SYSTEM

- A. Mark all piping installed under this Section with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Apply markers every 20 feet on center on piping which is exposed in mechanical or storage areas and above suspended accessible ceilings. Also, apply at all access panels, valves, tee joints, alarms, and/or controls.
- B. Adhesive system may be used throughout except at the mechanical rooms in which case markings shall be painted on.

1.16 VALVE TAGS

- A. All valves installed in the Fire Protection Contract shall be tagged. Tags shall be secured to valves with chain link and shall be marked with 3/4 inch high letters as to function. All valve tags shall indicate the Fire Zone.
- B. A corresponding framed Valve Tag Chart shall be installed within each Sprinkler Riser or Control Valve Room indicating location of each valve and the section it serves. This chart shall also be included within the Owner's O&M Manual with valve tag locations noted on the As-Built Sprinkler drawings.

1.17 IDENTIFICATION SIGNS

- A. All equipment and systems shall be identified with signs furnished and attached in accordance with NFPA 13.

1.18 PAINTING

- A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Fire Protection Subcontractor and left ready to receive primer coat.
- B. Painting for pipe markings shall be done under this Section.

1.19 WATER SUPPLY TEST DATA

- A. The following water supply data is included as information available to bidders.
- B. A hydrant flow test was performed on October 31, 2018, by Fire Protection Services at 31 Flagg Drive, Framingham, MA. Flow hydrant was located to the northwest corner of the existing Fuller Middle School. Gage hydrant was located on Flagg Drive, across from the existing Fuller Middle School.
- C. Flow Test Results:
 - 1. Static Pressure = 87 PSI
 - 2. Residual Pressure = 78 PSI
 - 3. Flow = 1,048 GPM
 - 4. Estimated Flow at 20 PSI = 3,098 GPM

1.20 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, TEMPORARY FACILITIES AND CONTROLS.

1.21 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.22 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 – General Commissioning Requirements and Section 21 08 00 Commissioning of Fire Protection Systems.
- B. Complete installation and startup checks and functional tests according to Section

019113 – General Commissioning Requirements and manufacturers written instructions and Section 21 08 00 Commissioning of Fire Protection Systems.

- C. Operational Test: After plumbing systems have been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113 & 23 08 00 and manufacturers written instructions/requirements.

1.23 BREAKDOWN

- A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.
- B. No requisition will be approved until the breakdown is delivered to the Architect.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and equipment furnished under this Section shall be new, unused, first quality of a manufacturer of established reputation and shall be U.L./F.M. approved. Each valve, fitting, section of pipe, and piece of equipment shall have cast or indelibly stamped thereon the manufacturer's name and pressure rating where applicable. All threads for fire department connection shall conform to the standards of the Local Fire Department.

2.2 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. Standards. All grooved products shall be of one manufacturer to conform to NFPA Standards.
- B. All piping installed under this Section shall be in accordance with the following:

<u>Service</u>	<u>Materials</u>
Trim piping around alarm valves, sprinkler piping 1-1/2 inch and smaller	ASTM A-53, Schedule 40 black steel pipe
Sprinkler and standpipe piping 2 inch and larger	Schedule 10, ASTM A-135 U.L./F.M. black steel pipe
Underground service	CL 52 ductile iron pipe
- C. Fittings on fire line piping, 2 inch and larger, shall be Victaulic Fire Lock Ductile Iron Fittings conforming to ASTM A-536 with integral grooved shoulder and back stop lugs and grooved ends for use with Style 009-EZ or Style 005 couplings.
- D. Fittings for standpipes and risers, 2-1/2 inch and larger, and where ever required

to conform to Seismic Requirements shall be Victaulic Vic-Flex Style 75 or 77 with Fire Lock Gasket.

- E. Branch line fittings shall be welded or shall be Victaulic 920/920N Mechanical Tees.
- F. Schedule 10 pipe shall be roll grooved. Schedule 40 pipe where used with mechanical couplings shall be rolled groove and shall be threaded where used with screwed fittings.
- G. Fittings for threaded piping shall be malleable iron screwed sprinkler fittings.
- H. All pipe and fittings shall be U.L./F.M. approved for sprinkler and standpipe service. All pipe and fittings shall be galvanized for dry system and black for wet system.
- I. Fittings on underground fire service piping shall be 250 psi gray iron fittings with mechanical joint ends. Coordinate with site contractor to assure all joints are properly thrust blocked.
- J. Grooved fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.

2.3 JOINTS

- A. Threaded pipe joints shall have an approved thread compound applied on male threads only. Teflon tape shall be used for threads on sprinkler heads.
- B. Joints on piping, 2 inch and larger, shall be made up with Victaulic, or equal, Fire Lock Style 005, rigid coupling of ductile iron and pressure responsive gasket system for wet or dry sprinkler system as recommended by manufacturer. Couplings on dry systems shall be galvanized. Cutting, roll grooving, lubrication, and assembly of all joints shall be made strictly in accordance with manufacturer's recommendations. Exercise particular caution in the use of lubricant to avoid "squeeze out" of lubricant when system is in service.
- C. Grooved joints and fittings shall be manufactured by Victaulic, Grinnell, Anvil, or equal.
- D. Furnish and install where piping crosses building expansion joints a listed expansion joint. Expansion joints shall be Metraflex "Fireloop", or manufactured by Flexonic Company or Hyspan, or equal. Expansion joints shall be UL approved for use for fire sprinkler systems.
- E. All joints on Fire Service under slab shall be restrained up to the service stub flange connection above slab.

2.4 VALVES

- A. All shutoff and control valves shall be U.L./F.M. approved, indicating type valves equipped with a supervised trouble switch wired to the fire alarm system. Shutoffs and zone valves may be either OS&Y indicating gates or butterfly valves.
- B. Gate valves shall be outside screw and yoke indicating type, 175 psi W.P. and U.L./F.M. listed, Jenkins or equal. All such valves shall have supervised trouble

switch.

- C. Butterfly valves shall be Victaulic Series 705-W for 2-1/2 inch and larger, and Milwaukee indicating type U.L./F.M. butterball for threaded service. Coordinate with Electrical Sub-contractor to have factory installed monitor switches compatible with the remainder of the Fire Alarm System.
- D. Check valves shall be iron body bronze mounted U.L./F.M., 175# W.P. or U.L./F.M. wafer checks. Grooved end valves shall be Victaulic Style 717 Fire Lock Check Valve.
- E. Pressure relief valves shall be located on wet systems pressure regulating valves and downstream of check valves per NFPA-13-2013. Pressure relieve valves shall be listed and not less than 1/2 in. in size and shall be by AGF, Watts, Cla-Val or equal.
- F. Ball drips shall be Potter Roemer #5682, 3/4 inch straight design ball drip valve, or by Victaulic, Viking, or equal.
- G. Drains shall be provided in the systems as may be required by field conditions. Provide drains at all low points and wherever necessary to insure that all portions of the sprinkler piping may be completely drained. Test connections shall be provided as required to test all portions of the system. Pipe low point drains and test connections to suitable receptor as determined in field or shown on Drawings.
- H. Install an inspector's test connection at the furthest point of each sprinkler zone. Run discharge back to a suitable receptor. Exterior wall penetration is permitted with test drain but only as approved by the Architect.
- I. Valves shall be manufactured by Victaulic, Nibco, Viking, or equal. Inspector's test stations shall be manufactured by AFG, Tyco, Victaulic, or equal.

2.5 SPRINKLERS

- A. All sprinklers to be used on this project shall be Quick Response type and shall be stamped with date of manufacture and temperature rating. Temperature ratings shall be determined by the location of the heads per NFPA 13-2013, section 8.3.2.5, and shall be minimum 155 degrees F. throughout except in special areas around heat producing equipment and skylights, in which case use temperature rating to conform with hazard as specified in NFPA 13-2013. Orifice diameter and K factor shall be appropriate to meet the hydraulic design criteria, the available water supply, and NFPA Standards.
- B. Furnish spare heads of each type installed located in a cabinet along with special sprinkler wrenches. The number of spares and location of cabinet shall be in complete accord with NFPA 13-2013.
- C. Sprinklers shall be manufactured by Tyco, Victaulic, Viking, or equal.
- D. Upright sprinkler heads in areas with no ceilings shall be Tyco Model "TY-FRB" Quick Response, upright natural brass finish heads. Include heavy duty sprinkler guards in all mechanical rooms, storage rooms, gymnasium, Stage and general shop/maker spaces.

- E. Sidewall heads shall be Tyco Model "TY-FRB" Quick Response with chrome head and custom color escutcheon. The custom color shall be per Architect.
- F. Pendent wet sprinkler heads shall be Tyco Model "TY-FRB" Quick Response recessed adjustable escutcheon, custom color finish. The custom color shall be per Architect.
- G. Concealed heads shall be Tyco Model "RFII" Quick Response concealed type, 1-1/2 inch adjustment with custom cover plate. The custom color shall be per Architect.
- H. Pendent dry sprinkler heads shall be Tyco Model "DS-1" Quick Response dry type, white polyester finish and escutcheon.
- I. Dry sidewall heads shall be Tyco Model "DS-1" dry horizontal sidewall heads, with matching brick finish.
- J. Window sprinkler heads shall be Tyco Model "WS" pendent vertical sidewall heads, with custom color finish selected by Architect .
- K. Use of flexible stainless steel hose with fittings for fire protection service that connect sprinklers to branch lines in suspended ceilings is acceptable. Flexible hoses shall be UL/FM approved and shall comply with NFPA 13 standards. Hose assemblies shall be type 304 stainless steel with minimum 1-inch true-bore internal hose diameter. Ceiling bracket shall be galvanized steel and include multi-port style self-securing integrated snap-on clip ends that attach directly to the ceiling with tamper resistant screws.

2.6 FIRE DEPARTMENT CONNECTION

- A. Fire Department Inlet Connection shall be Croker #6350 Series; 4 inch Storz inlet x 4 inch outlet, Satin brass plate, and stamped "Sprinkler-Standpipe". Install 1/2" ball drip valve and Satin bronze plated trim wall fitting on bottom of inlet fitting body. Provide access panel for servicing the ball drip.
- B. Fire Department Connection shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

2.7 FIRE STANDPIPE EQUIPMENT

- A. Fire Department Valves shall be Croker Series 5015 Fire Department Valves fitted with 2-1/2 inch x 1-1/2 inch reducer, caps and chains all conforming to Local Fire Department thread standard. Valves shall be polished chrome plated and shall be mounted in a recessed cabinet as indicated on Drawings.
- B. Cabinets for the Fire Department Valves shall be Croker model 1710 - 18 inch x 18 inch x 10 inch deep. cabinet, fully recessed, solid door, prime painted steel. Include graphic and door catch.
- C. Provide 32 inch x 32 inch access panels at floor control locations or recessed cabinets as appropriate to the wall construction. Provide graphic.
- D. Cabinets and access panels provided at fire standpipe equipment shall be fitted

with pull handles. Cylinder locks are not allowed.

- E. Cabinets and valves shall be manufactured by Croker, Potter Roemer, Elkhart, or equal.

2.8 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

- A. Furnish and install All Supplementary Steel, Channels, and Supports required for the proper installation, mounting, and support of all equipment.
- B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.
- C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Fire Protection Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
- D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 degree fittings, as required to suit the construction and installation conditions.

2.9 HANGERS AND RESTRAINTS

- A. Hangers shall be furnished, installed, and supported from the building structure in accordance with NFPA – 13.
- B. All piping shall be restrained per NFPA 13.

2.10 ALARM DEVICES

- A. Flow switches shall be vane type water flow detectors with 0-90 Sec. Adjustable non-accumulative retard device and (2) single pole double throw contacts, Notifier Series WFD Potter, VSR.F or equal. At base of standpipe risers, flow switch shall be a non-water discharge, auto-test vane type water flow detector with 0-90 second adjustable non-accumulative retard device and (2) single pole double throw contacts, Potter VSR.AT or equal. The flow switch shall be paired with either a single gang box test switch, Potter ATC-1 for testing a single device or ATC-4 for testing up to four devices.”
- B. Pressure switches shall be adjustable Potter Model PS10A or equal.
- C. High/Low pressure switches shall be adjustable Potter Model PS40A or equal.
- D. Supervisory switches on all O.S. & Y. gate valves shall be Notifier NGV complete with mounting bracket.
- E. The wet system alarm device shall be Reliable Model 'E' alarm valve with “E1” trimmings. Package to include electric bell.
- F. Refer to Drawings for additional devices. Co-ordinate, prior to ordering devices, with the Electrical Sub-Contractor to assure device compatibility with the Fire Alarm System.

- G. Alarm valves shall be as manufactured by Reliable, Victaulic, Tyco, or equal. Flow, pressure and supervisory switches shall be manufactured by Potter, Notifier, System Sensor, or equal.

2.11 DOUBLE CHECK VALVE ASSEMBLY

- A. Double check valve assembly shall be State approved, U.L./F.M. approved, with iron body bronze mounted construction complete with supervised OS & Y gate valves and test cocks. Furnish two spare sets of gaskets and repair kits.
- B. Double check valve assembly shall be of one of the following:
 - 1. Watts Series 757-OSY
 - 2. Wilkins 350A-OSY
 - 3. Conbraco Series 4S-100
 - 4. Or equal.
- C. In the name of the owner pay for, file for, and obtain required permits from D.E.P. and/or local authority whichever has jurisdiction prior to installation.

2.12 ACCESS DOORS

- A. Furnish Access Doors for access to all concealed control valves, drains, inspector's tests, supervisory devices, and to all other concealed parts of the system that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate Section of the Specifications for the surface upon which the panels are mounted.
- B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 inch x 16 inch). When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.
- C. Access Doors shall be prime painted and be complete with cylinder lock and two keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Lector". Type shall be as follows:

Acoustical Tile Ceiling	Acudor AT-5020
W.B. Surfaces	Acudor DW-5040
Masonry Construction	Acudor UF-5000
Fire Rated Construction	Acudor FB-5060

- D. Access Doors Shop Drawings shall be submitted to the Architect for approval.

2.13 UNDERGROUND PIPE

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi.
 - 1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron

standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile or gray iron glands, rubber gaskets, and steel bolts.
- B. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, round-grooved ends.
1. Grooved-End, Ductile-Iron Pipe Appurtenances: ASTM A47, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe, 350 psi.
 2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions, Include ferrous housing sections, gasket suitable for water, and bolts and nuts. Joints shall be Tyton.
 3. Gaskets: AWWA C111.
- C. Cement Mortar Internal Lining: Cement mortar lining and bituminous seal coat as per AWWA C104.
- D. Exterior Pipe Coating: The exterior of pipe shall have the standard asphaltic coating.
- E. Provide fittings, supports, thrust blocks etc. per NFPA 13, Chapter 10.

2.14 TAPPING SLEEVES

- A. Tapping sleeves shall be iron bodied and have a maximum working pressure of 250 psig and certified to ANSI/NSF 61. Outlet flange dimensions and drilling shall comply with ANSI B16.1, class 125 and MSS SP-60.
- B. Couplings to be used in connecting two plain ends of cast, ductile iron, or PVC pipe shall be of cast or ductile iron with bolts and nuts complying with AWWA C111. Couplings shall be Dresser Style 38, Smith-Blair Style 441, Clow Type F12308, or approved equal.

2.15 DETECTABLE UNDERGROUND WARNING TAPE

- A. Detectable warning tape shall be installed 12" directly above all buried utilities. Detectable warning tape shall consist of a nominal 4.5 mil (0.0045") overall thickness and 6" wide, with a solid aluminum foil core. The imprinted warning message is "Buried, or Encased" to prevent rub-off, and is impervious to acids, alkalis and other destructive elements found in soil. The imprint is as such that it allows for total reflectivity. A tape must be visibly seen before it can be read. The tape shall meet the testing requirements of ASTM D-882, Method A.
- B. Legend/Color & Imprint:
1. Tape shall read "CAUTION BURIED WATER LINE BELOW".
 2. Tape color coding shall be Blue.

2.16 FIRESTOP SYSTEMS

- A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.

- B. Refer to Section 078400 - Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.17 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
 - 3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 - Temporary Facilities and Controls.
 - a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.18 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - Temporary Facilities and Controls.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

- A. All work shall be installed in a first-class manner consistent with the best current trade practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.
- B. Protect all concealed heads. Coordinate and advise finishing trades so as to prevent painting of sprinkler heads or inadvertent filling with paint or jointing compound of required air spaces in the case of the concealed type sprinkler heads.
- C. Training:
 - 1. Train the Owner's maintenance personnel on troubleshooting procedures, and

- servicing and preventative maintenance schedules and procedures.
- 2. Schedule training with Owner through the Architect with at least 7 days prior notice.

3.2 WORK COORDINATION AND JOB OPERATIONS

- A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.
- B. Before materials are purchased or work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces.
- C. Coordination Drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- D. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.
- E. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.
- F. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Fire Protection installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.
- G. In case of failure to give proper information as indicated above, sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.
- H. Obtain from the other trades, all information relative to the Fire Protection Work to be executed in conjunction with the installation of their respective equipment.

3.3 CUTTING AND CORE DRILLING

- A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings.
- B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.
- C. Use a core drilling process which produces clean, sharp edges and the minimum

hole size which will accommodate the size of pipe sleeve specified.

- D. Patch all holes up to the sizes indicated in this Section with material and methods as are specified in the Section of the Specifications for the finish trade involved. Holes which are improperly done due to poor materials or method, shall be patched to the satisfaction of the Architect by the finish trade and back-charged to this Subcontractor.

3.4 CLEANING AND PROTECTION

- A. Protect all materials and equipment during shipment and installation and properly handle and store at the job site so as to prevent damage. Assume full responsibility for protection of work until its completion and final acceptance.
- B. Keep the premises reasonable clean at all times and remove rubbish caused by the Fire Protection work as directed by the Architect.
- C. Upon completion of this work, clean all sprinklers, and equipment and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work by others.

3.5 SLEEVES, INSERTS, AND ESCUTCHEONS

- A. All piping passing through slabs, floors, walls, and partitions shall be sleeved and all such sleeves shall be furnished and installed by the Fire Protection Subcontractor as detailed on the Drawings and herein specified. Fire Protection Contractor, shall do his core drilling as approved by the Architect and the cored opening shall have a sleeve caulked and leaded in place. Set sleeves in concrete floors and walls as soon as forms set and before concrete is poured.
- B. All pipes passing through floor, whether slab-on grade or above grade levels shall be sleeved with sleeve extending 1 inch above floor. This includes all piping in toilet room pipe space, stairwells, closets, and partitions. In mechanical penthouses, pipe sleeves shall extend 4 inches above floor.
- C. All sleeves shall be Schedule 40 galvanized steel pipe and shall be reamed. There shall be annular space between the sleeve and pipe per NFPA requirements. Sleeves on drywall, masonry, or concrete walls and partitions shall be flush with wall on both sides.
- D. The space between sleeve and pipe, in all cases, shall be filled with U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.
- E. Inserts, where required, shall be furnished and set by the Fire Protection Subcontractor and, where necessary, may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 inch into concrete.
- F. Escutcheons: All exposed pipe, uncovered, passing through walls, or floors, or ceilings, shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.6 TESTING

- A. Flush the system and test all work in the presence of the Architect and/or Engineer and as required by NFPA and the Insurance Company. The flushing and testing procedures to be followed are specified herein. At the completion of the testing, submit fully executed copies of Contractor's Material and Test Certificate for both above ground and underground piping as contained in NFPA-13.
1. Water Supply:
 - a. Flushing: Underground/exterior service entrance shall be flushed at a minimum velocity of 10 fps in accordance with NFPA Standards 13, 14, and 24. The Fire Protection sub-contractor shall coordinate with the Water and Fire Departments prior to testing of the entire exterior system.
 2. Sprinkler System:
 - a. Hydrostatic Testing: The interior system shall be hydrostatically tested at 200 psi for 2 hours in accordance with NFPA 13 paragraph 25.2.1.
 - b. Operational Testing: Water flow switches and associated alarm systems shall be tested by water flow through the inspectors test assemblies in accordance with NFPA 13, 25.2.3.
 - c. Main Drain Test: A flow test shall be performed on the main drain valve and recorded on the Contractor's test certificate in conformance with NFPA 13, 25.2.3.4.
 - d. Backflow Preventor Flow Test: The double check valve assembly shall be flow tested in conformance with NFPA 13, 25.2.5. Provide piping and or valving arrangement to preform full flow testing of backflow device.
 - e. Underground Piping: Underground piping shall be hydrostatically tested, flushed and chlorinated in accordance with NFPA 24, the Local DPW, and any other pertinent laws or governing standards. Flushing, Testing and chlorination reports shall be given to the owner for review and included in the O&M Manuals for the fire protection systems.
 3. Standpipe or Bulk Fire Main:
 - a. Flushing: The fire department connection piping shall be flushed at a minimum velocity of 10 fps in conformance with NFPA 13, and NFPA 14.
 - b. Hydrostatic Testing: All piping shall be pressure tested at 200 psi for 2 hours in conformance with NFPA 14.
 - c. Flow Tests: The system shall be flow tested at the hydraulically most remote hose connection in conformance with NFPA 14.
 - d. Valve and Supervisory Switch Test: All valves and tamper switches will be tested by opening and closing valves in conformance with NFPA 14.

3.7 FIRESTOP SYSTEMS:

- A. General: Install firestop systems at all new fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 078400 - Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.8 SYSTEM SHUTDOWNS

- A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shut downs as much as possible. Submit a list of all affected areas, the proposed work to be performed, and the expected length of the shut-down including time for retesting.
- B. Provide temporary services to maintain active system during extended shut-downs as required for demolition and construction phasing.

END OF SECTION

Section 21 00 01

FIRE PROTECTION TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
1. Specification requirements for Trade Contract "FIRE PROTECTION" include all of the following listed Specification Sections: in their entirety:
 - a. Section 21 00 00 –FIRE PROTECTION.
 - b. Section 21 00 01 –FIRE PROTECTION TRADE CONTRACT REQUIREMENTS.
 - c. Section 21 08 00 - COMMISSIONING OF FIRE SUPPRESSION
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.
1. None.
- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A102, A103, A101C, A102C, A103C, A200, A544, S000, S101C, S102C, S103C, S104C, LS001, LS101, LS102, LS103, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A422, A423, A425, A427, A440, A441, A426, A431, A433, A434, A690, A451, A541, FP001,

FP104, A181, A181A, A181B, A181C, A181D, A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A691, FP101A, FP101C, FP101D, FP102A, FP102B, FP102C, FP102D, FP103A, FP103B, FP103C, A101A, A101B, A101D, A102A, A102B, A102D, A103A, A103B, A700, A453, A452, A002, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, A802, TE000, TE001, TE111, TE112, TE121, TE122, TE141, FS100, FS101, FS102, FS103, S302, S001, S002, S003, S101A, S101B, S101D, S101L, S102A, S102B, S102D, S103A, S103B, S103D, S104B, S104D, S105B, S105C, S200, S201, S202, S203, S204, S205, S300, S301, S303, S304, S305, S400, S401, S500, S501, S502, S503, S504, S600, S601, S602, S603, S604, S700, S701, C 2.1, C 2.3, C 4.0, C 4.1, C 4.2, C 6.0, C 6.1, C 6.2, VS101

2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.

G. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Trade.

H. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.

1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE
CONTRACTOR: _____
TRADE CONTRACT FOR TRADE: FIRE PROTECTION.

2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 RELATED REQUIREMENTS

- A. Section 11 40 00 - FOODSERVICE EQUIPMENT.
- B. Section 22 00 00 - PLUMBING.
- C. Section 23 00 00 – HVAC.
- D. Section 26 00 10 – ELECTRICAL

1.4 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's

failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.5 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures

necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).

- a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
- b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 21 08 00

COMMISSIONING OF FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This section includes commissioning process requirements for Fire Suppression systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

- A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.
- B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:
- C. Certificates of readiness
- D. Certificates of completion of installation, prestart, and startup activities.
- E. O&M manuals
- F. Test reports

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the contractor for the equipment being tested. For example, the fire protection contractor of Division 21 shall ultimately be responsible for all standard testing equipment for the plumbing system in Division 21.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for applicable commissioned components, equipment, and systems.

-
- B. Red-lined Drawings: The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.
 - C. Operation and Maintenance Data: Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the contractor.
 - D. Demonstration and Training: Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the contractor to the CxA four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior the training session.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Perform tests that are specified in the Division 21.
- B. Attend construction phase coordination meetings.
- C. Participate in Fire Suppression systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- D. Provide information requested by the CxA for final commissioning documentation.
- E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- F. Prepare preliminary schedule for Fire Suppression system orientations and inspections, operation and maintenance manual submissions, training sessions, flushing and cleaning, equipment start-up, and task completion for owner. Distribute preliminary schedule to commissioning team members.
- G. Update schedule as required throughout the construction period.
- H. Assist the CxA in all verification and functional performance tests.
- I. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- J. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.

-
- K. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
- L. Participate in, and schedule vendors and contractors to participate in the training sessions.
- M. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
1. Life Safety/Fire Suppression equipment including pumps, piping, and all other equipment furnished under this Division.
 2. Automatic sprinkler and standpipe systems.
 3. Fire stopping in fire rated construction, including caulking, gasketing and sealing of smoke barriers.
- N. The equipment supplier shall document the performance of his equipment.
- O. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.
- P. Equipment Suppliers
1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
 2. Assist in equipment testing per agreements with contractors.
 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
- Q. Refer to Division 01 Section "General Commissioning Requirements" for additional contractor responsibilities.
- 3.3 CxA'S RESPONSIBILITIES
- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.
- 3.4 TESTING PREPARATION
- A. Certify in writing to the CxA that Life Safety/Fire Suppression systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the CxA that Life Safety/Fire Suppression instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- D. Inspect and verify the position of each device and interlock identified on checklists.

-
- E. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
 - F. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.5 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of Life Safety/Fire Protection testing shall include entire Fire Suppression installation. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions.
- D. The CxA along with the Fire Suppression contractor shall prepare detailed testing plans, procedures, and checklists for Fire Suppression systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the Fire Suppression system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.6 FIRE SUPPRESSION SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 21 sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. Fire Suppression Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of sprinkler distribution systems.

-
- C. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

<i>Fire Suppression Systems</i>
--

Fire suppression systems

3.7 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.

3.8 APPROVAL

- A. Refer to Division 01 Section "General Commissioning Requirements" for approval procedures.

3.9 DEFERRED TESTING

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deferred testing.

3.10 OPERATION AND MAINTENANCE MANUALS

- A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
- B. Refer to Division 01 Section "General Commissioning Requirements" for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.11 TRAINING OF OWNER PERSONNEL

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to training.

End of Section

Section 220000

PLUMBING

(Filed Sub-Bid Required)

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END OF INDEX

Section 22 00 01

PLUMBING

(Filed Sub-Bid Required)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. GENERAL PROVISIONS
- B. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- C. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.
- D. Trade Contract Requirements: As provided under Section 22 00 01 – PLUMBING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
- E. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 22 00 01.

1.2 REQUIREMENTS FOR FILING SUB-BIDS

- A. Sub Sub-Bid Requirements: Referenced in Paragraph 2.5 Insulation of this section.

1.3 DESCRIPTION OF WORK

- A. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional, as indicated in the Contract Documents and as specified herein.
- B. Work to be done under this Section is shown on Contract drawings numbered below. For a complete list of drawings, refer to architectural title sheet drawing.

The plumbing drawings are P001, P002, P003, P004, P005, P100A, P100B, P100C, P100D, P101A, P101B, P101C, P101D, P102A, P102B, P102C, P102D, P103A, P103B, P103C, P103D, P104, P200, P201, P300, P400, P401, P402, P403 and P500. The Plumbing Trade Contractor shall also review all other Drawings and all other Sections of the Specifications for coordination requirements therein affecting the Work of this Section, not just those pertaining to this Sub-trade.

- C. The work covered by this Section of the Specifications includes the furnishing of all labor and materials and in performing all operations in connection with the installation of the Plumbing Work.
- D. Without limiting the generality thereof, the work to be performed under this Section includes:
1. Domestic cold water system throughout the entire building connecting to each and every fixture and piece of equipment requiring domestic cold water. The cold water system shall extend and connect to the cold water main ten feet outside of the building.
 2. Sanitary waste and vent system throughout the entire building connecting to each and every fixture and piece of equipment requiring sanitary drainage. This system shall extend and connect to the sanitary main ten feet outside of the building.
 3. Storm water drainage system throughout the entire building connecting to each and every roof and areaway drain requiring storm drainage. This system shall extend and connect to the storm main ten feet outside of the building.
 4. Special Waste and Vent System (Acid Waste) including neutralizer and pH monitoring system. Acid waste pipe 10 ft. outside the building.
 5. Kitchen grease waste and vent system including exterior precast concrete grease trap, manholes, and cast iron piping within the exterior grease trap.
 6. Hot, and Hot Water Re-circulation System throughout the entire building connecting to each and every fixture and piece of equipment requiring domestic cold and hot water.
 7. Lab. Non-Potable Cold and Hot water.
 8. Electric heat tracing for Lab Non- Potable hot piping to maintain temperature
 9. Natural gas system throughout the building connecting to each and every outlet and appliance requiring natural gas. This system shall extend and connect to the house side of the meter provided by the Utility Company.
 10. Gas piping and connection to outdoor emergency generator.
 11. Floor, Roof and Trench Drain and piping.
 12. Furnish and install domestic water heater air intake and exhaust breeching.
 13. Furnish and install boiler air intake and exhaust breeching.
 14. Insulation.
 15. Domestic Hot Water Heater.
 16. Science Classroom Emergency Gas Solenoid Valve
 17. Kitchen CO and Gas Control Valve
 18. Fixtures and Equipment
 19. Connection to Equipment Furnished by Division 11.
 20. Flushing, Sterilization, and Tests
 21. Furnishing of Access Panels
 22. Drilling, Coring and Cutting & Patching of holes and openings where the largest dimension thereof does not exceed 12 inches for Plumbing Piping and Equipment.

23. Provide and maintain temporary water service as directed by General Contractor. General Contractor to pay for all water use.
 24. Scaffolding, Rigging, and Staging required for all Plumbing Work. Comply with Division 1 requirements.
 25. Preparation of Co-ordination Drawings.
 26. Smoke and Firestopping Seals and sealing of all wall penetrations as detailed on the drawings. Refer to Section 078400 which defines the firestopping materials and methods.
 27. At Project close out the Plumbing Sub-Contractor shall provide the services of an outside firm who shall run an underground video camera, locating all drainage system lines including depth, preparing a video and identifying & correcting any problem areas. The Plumbing Sub-Contractor shall rod-out and power wash all underground drainage systems. Turn over 4 copies of the video and written report to the owner. Videos are required for the underground sanitary, storm, kitchen waste, garage waste, and special waste systems.
 28. It shall be the responsibility of this division 22 00 00 to provide all personnel as required to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this division 22 00 00 and the Testing requirements shall be in addition to those tests and requirements outlined in section 01 91 13 & Section 22 08 00 and required to fulfill section 01 91 13 & Section 22 08 00 commissioning obligations.
 29. When open-flame or spark producing tools such as blower torches, welding equipment, and the like are required in the process of executing the work, the General Contractor shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant non-working fire watch, paying all fees, where work is being performed and until it is completed. Fee for fire watch shall be included in the bid.
- E. Sustainable Design Intent: Comply with project requirements measured and documented according to LEED V4. Project scores will be verified by a third party certifier.
1. Refer to section 018113 – Sustainable Design Requirements, for material, procedure, and documentation submittal requirements.
 2. Recycled content – for products or materials that contain recycled content, fill out the Materials Submittal Cover Sheet. Show percentage of product that is post-consumer and/or post-industrial recycled content. Provide backup documentation as described in Section 018113. Show installed costs for each line item.

1.4 RELATED WORK

- A. The following Related Work will be performed under the designated Sections:
1. Domestic Water Service 10 ft. outside – DIVISION 33 – UTILITIES

2. Installation of flashing for Roof drains and vents through roof: SECTION 07 00 02 - ROOFING & FLASHING
3. Cast in Place Concrete: Section 03 30 01
4. Cutting And Patching: Section 01 73 00 Execution
5. Electric Power Wiring: SECTION 26 00 00 - ELECTRICAL
6. HVAC Equipment: SECTION 23 00 00 - HVAC
7. Excavation and Backfill: DIVISION 31 - EARTHWORK
8. Sanitary Sewer and storm drains 10 feet outside the foundation wall: DIVISION 33 - UTILITIES
9. Finish Painting: SECTION 09 91 00 - PAINTING
10. Installation of Access Panels: SECTION 08 31 00 Access Door and Panels.
11. Toilet Room Accessories: SECTION 10 28 13 - TOILET ACCESSORIES
12. Temporary Facilities: SECTION 01 50 00 - TEMPORARY FACILITIES
13. Food Service Equipment: SECTION 11 40 00 FOOD SERVICE EQUIPMENT
14. Laboratory : SECTION 11 53 00 LABORATORY EQUIPMENT
15. Laboratory Sink and countertop Section 12 35 53

1.5 CODES, ORDINANCES, AND PERMITS

- A. Perform all work in accordance with the requirements of the Town of Framingham Building Department, Massachusetts State Plumbing and Fuel Gas Codes, D.E.P., A.D.A., NFPA, The Architectural Barrier Code, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform all Plumbing Work. Where the Contract Documents indicate more stringent requirements than the above Codes and Ordinances, the Contract Documents shall take precedence.
- B. Obtain all permits, inspections, and approvals, from the governing authorities and pay all fees and include cost in the bid, including approvals for the cross connection control device. Provide the Owner with the cross connection permit for the device in the Owner's name.
- C. Owner will pay all related Gas Utility Company back charges.

1.6 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Designer in writing before Award of Contract. Otherwise, Designer's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted due to discrepancies or unclarity thus resolved.
- B. Where Drawings or Specifications do not coincide with manufacturers' recommendations, or with applicable codes and standards, alert Designer in writing before installation. Otherwise, make changes in installed work as Designer requires within Contract Price.

- C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specs, this subcontractor shall provide that material, installation, or work which is of the higher standard.
- D. It is the intent of these contract documents to have the subcontractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of a component. In cases such as this, where the subcontractor has failed to notify the Designer of the situation in accordance with the paragraph above, the subcontractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.
- E. In cases covered by the paragraph above, where the subcontractor believes he needs engineering guidance, he shall submit a sketch identifying his proposed solution and the Designer shall review, note if necessary, and approve the sketch.

1.7 MODIFICATIONS IN LAYOUT

- A. HVAC, Plumbing, Fire Protection, and Electrical Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show the exact routings and locations needed to coordinate with structure and other trades and to meet architectural requirements.
- B. In all spaces, prior to installation of visible material and equipment, including access panels, review Architectural Drawings for exact locations and where not definitely indicated, request information from Designer.
- C. Check Contract Drawings as well as Shop Drawings of all subcontractors to verify and coordinate spaces in which work of this Section will be installed.
- D. Maintain maximum headroom at all locations. All piping and associated components to be as tight to underside of structure as possible.
- E. Make reasonable modifications in layout and components needed to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, D above. Systems shall be run in a rectilinear fashion.
- F. Where conflicts or potential conflicts exist and engineering guidance is desired, submit sketch of proposed resolution to Designer for review and approval.

1.8 SHOP DRAWING AND MATERIAL SCHEDULES

- A. Refer to SECTION 013000 - SUBMITTALS for submittal of Shop Drawings. If apparatus or materials are substituted for those specified, and such substitution necessitates changes in or additional connections, piping, supports or construction, same shall be provided as the responsibility, and at the expense, of the Plumbing Subcontractor.

- B. Fabrication of any material or performing of any work prior to the final approval of the Submittals will be entirely at the risk of the Plumbing Subcontractor. The Plumbing Subcontractor is responsible for furnishing and installing materials called for in the Contract Documents, even though these materials may have been omitted from approved Submittals.
- C. Submit Shop Drawings for the following materials and equipment.
 - 1. Valves, Piping, couplings and Fittings
 - 2. Fixtures, Drains and Equipment including Supports
 - 3. Backflow Preventers
 - 4. Access Panels and Covers
 - 5. Insulation
 - 6. Drains, and Hydro Mechanical Specialties
 - 7. Hose Bibs, Wall Hydrants
 - 8. Hangers, Anchors, Guides, and Supports including Restraints
 - 9. Cleanouts
 - 10. Piping Identification System
 - 11. Water Heating Equipment
 - 12. Acid Neutralizer tank and monitoring equipment
 - 13. Air Compressors
 - 14. Water heater and boiler air intake and exhaust breeching including coordinated working drawings of installation.
 - 15. Precast concrete tank for acid neutralizers separator and access manholes.

1.9 COORDINATION DRAWINGS

- A. Before materials are purchased or Work is begun, prepare and submit to the Architect, Coordination Drawings showing the size and location of all equipment and piping lines relevant to the complete system. Ensure that these Drawings are compatible and correctly annotated and cross-referenced at their interfaces (match lines).
- B. Coordination Drawings are for the subcontractor's and the Architect's use during Construction and shall not be construed as replacing any Shop or Record Drawings required elsewhere in these Contract Documents.
- C. Detailed procedures for Coordination Drawings are contained in DIVISION 01 - GENERAL REQUIREMENTS of these Contract Documents.

1.10 RECORD DRAWINGS

- A. General: Refer to DIVISION 01 - GENERAL REQUIREMENTS for general requirements for maintaining as-built drawings and submitting final reproducible record documents.
- B. The General Contractor will provide two sets of Drawings to the Plumbing Subcontractor, one set of which shall be maintained at the site and which shall, at all times, be accurate, clear, and complete, showing the actual locations of all equipment

and piping as it is being installed. The Record Drawings shall be available to the Architect/Engineer's field representative at all times.

- C. Provide electronic AutoCAD drawings to indicate revisions to piping size and location both exterior and interior; including locations of valves and other equipment requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located.
- D. Include in the Record Drawings any addenda, sketches, and supplementary Drawings issued during the course of construction.
- E. Non-availability of Record Drawings or inaccuracies therein will postpone the final inspection until they are available.
- F. All valves shown on these Drawings shall be numbered with numbers corresponding to those on the valve charts.
- G. All costs related to the foregoing requirements shall be paid by the Plumbing Subcontractor.

1.11 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance procedures for all equipment and systems installed. At the completion of the project, turn over to the Architect four (4) complete manuals, in three-ring, loose-leaf binders, containing the following:
 - 1. Complete Shop Drawings of all equipment.
 - 2. Operation description for all systems.
 - 3. Names, addresses, and telephone numbers of all suppliers of the system.
 - 4. Preventative maintenance instructions for all systems.
 - 5. Spare parts lists of all system components.
 - 6. Four copies of video of below slab piping.
 - 7. Valve tag chart.
- B. Provide DVD recording of operation and maintenance training sessions and include as part of O & M Manual submittal. Training session video recording and DVDs shall be performed by a professional videographer. Provide indexed table of contents for DVD recording.

1.12 GUARANTEE

- A. Refer to Division 1 of the Contract. Guarantee all work under this Section free from defects in workmanship and materials for a period of one (1) year from the date of final acceptance of the building, as set forth in the Contract. Replace any such defective work developing during this period, unless such defects are clearly the result of bad usage of equipment. Where such defective work results in damage to work of other Sections of the Specifications, restore such work to its original condition by mechanics skilled in the affected trade.

1.13 DRAWINGS

- A. All work shown on the Drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use. The Plumbing Drawings are intended to show the main stacks and risers and may or may not necessarily show all runout piping particularly in lavatories and gang toilet areas. Plumbing subcontractor shall include all runout piping to all referenced scheduled fixtures and equipment appearing on the Plumbing Drawings.
- B. All floor drains installed on this project, including all kitchen floor drains and trough drains, shall be equipped with trap primers. The trap primer and piping that are not shown on the drawings and shall be located in the field by the Plumbing subcontractor as dictated by field piping conditions.
- C. The Plumbing Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- D. Refer to the Architectural, Structural, and other Mechanical and Electrical Drawings, which indicate the construction in which this Work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction proper. All measurements shall be taken at the Building.

1.14 VALVE TAGS, NAMEPLATES, AND CHARTS

- A. All valves on pipes of every description shall have neat circular brass valve tags at least 1-1/2 in. in diameter attached with brass hook to each valve stem. Stamp on these valve tags, in letters as large as practical, the number of the valve and the service, such as "H.W., C.W., GAS", for hot water, cold water, and gas respectively. The numbers for each service shall be consecutive. Where valves are located above ACT ceilings, furnish and install valve finder ceiling tack, tack shall be minimum 7/8 in. diameter with 1/2 in. steel point, color as determined by Owner.
- B. All valves on tanks and pumps shall be numbered by 3 in. red metal discs with white numbers 2 in. high, secured to stem of valves by means of small solid link brass chain, to correspond to numbers indicated for valves on the Record Drawings and on two (2) printed detailed lists. These printed lists shall state the numbers and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information such as requiring the opening or closing of another valve or valves when any one valve is to be opened and closed, and shall be prepared in form to meet approval of the Architect, and shall be framed under glass.
- C. Nameplates, catalog numbers, and rating identifications shall be securely attached to Electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

1.15 PIPE MARKER IDENTIFICATION SYSTEM

- A. Mark all piping installed under this Section and at all Access Panels with a marking system in basic colors conforming to those specified in ANSI/ASME A-13.1. Markings shall indicate pipe content and direction of flow. Markers shall be applied at all valves and tee joints, and on straight runs of pipe at every 20 ft.-0 in. on center.
 - B. Markers shall be vinyl snap-around pipe type system. Adhesive markings are not acceptable.
 - C. Clearly mark potable and non-potable water system with 4 inch wide colored bands, with arrow for direction of flow, every twenty-five (25) feet on center on all piping installed whether it is concealed or exposed and also on both sides of floor and/or wall penetrations. Mark potable water green and non-potable yellow. Within 6 in. of each band identify with letter "Potable C.W.", Non-Potable H.W." Color of letter shall match banding.
- 1.16 SANITARY, WASTE, VENT, KITCHEN GREASE WASTE AND VENT, GARAGE WASTE AND VENT, AND STORM SYSTEMS
- A. Furnish and install complete Sanitary, Waste, Vent, Kitchen Grease Waste and Vent, and Storm Drainage Systems (all hereinafter called Drainage Systems) to convey wastes from all Soil and Waste Stacks, Fixtures, Equipment, Kitchen Fixtures, and Roof Drains as indicated and/or described in these Plans and Specifications. Urinal waste shall be 2 in. cast iron or sizes indicated on the drawings. The use of double "Y's" in the horizontal shall not be permitted. All piping shall be installed straight and true and located concealed within building construction.
 - B. All horizontal Drainage Systems Piping within the building, 3 in. and smaller, shall be pitched at least 1/4 in. per ft. in the direction of flow. Drainage Piping 4 in. and larger shall be pitched at least 1/8 in. per ft. Make changes in direction of drainage lines with 45 wyes, long turn wyes, or sweep bends.
 - C. Furnish and install all cleanouts indicated on the Drawings and/or where required in Drainage Pipes regardless of size so that the distance between cleanouts does not exceed 45 ft. o.c. Cleanouts shall be installed at the base of all risers and at each change of direction.
 - D. Refer to drawings for termination points, which generally are connection to existing piping or to 10 feet outside the building.
 - E. The kitchen Grease Waste System shall be a completely separate system beginning at the exterior grease interceptor through the kitchen and vented individually through the roof. Do not connect soil lines to the grease waste nor sanitary vents to the grease vent. Furnish and install the cast iron tees and associated piping within the grease trap including 5-foot length on the outlet. All the piping within the grease trap shall be made up with caulked and leaded joints. Locate inlet and outlet tees below access manholes to allow for inspection and maintenance. Exterior grease trap and access manholes shall be provided by this Section, 220000.
 - F. The Garage Drainage System shall be a complete separate system piped from the interceptor. Vent through the roof without interconnection to any other building Drainage System including sanitary waste and vent.

1.17 DOMESTIC WATER SYSTEMS (POTABLE & LAB.NON-POTABLE)

- A. Furnish, install, sterilize, and test in accordance with the documents and the Plumbing Code, complete potable and non-potable Domestic Cold, Hot, and Hot Water Recirculating Systems including all piping, valves, low point drains, shock absorbers, hangers, insulation, backflow preventers and water heating equipment. Clearly mark the systems as provided above. This work shall start as indicated on the Drawings.
- B. In general, piping shall pitch upward in the direction of flow with each branch and riser separately valved and with 1/2 in. hose end drain on the outlet side of the valve and at all low points in the system. Install shutoff valves for each battery of fixtures and other valves as necessary to isolate any part of each system.
- C. Install shock absorbers on hot and cold water piping to each fixture. Provide shock absorbers at all quick closing valves and as shown on the Drawings and/or specified.
- D. Install a 1/2 inch hose bibb in each toilet room provided with a floor drain. The hose bibb shall be installed under a lavatory.
- E. Install a 1/2 inch hose bibb in each mechanical room.
- F. Furnish and install a ball valve, balancing valve and check valve at each hot water recirculation line before it connects to another hot water recirculation line.
- G. At all faucets connecting to the non-potable system whether furnished hereunder or by other sections, provide a "water unsafe" sign.

1.18 EMERGENCY TEMPERED WATER SUPPLY

- A. A tempered water supply to service all emergency showers and eye wash units. This piping shall be hung and insulated the same as above. Piping shall start at the tempering mixing valve. Furnish and install flow switch at each emergency fixture location.

1.19 FUEL GAS SYSTEM

- A. Furnish and install a complete Natural Gas Supply System including pipe, fittings, valves, connections to all gas fired equipment requiring gas, and all accessories and incidentals as indicated or specified. Installation shall be made in accordance with the State Gas Code requirements. Piping shall be installed with an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out.
- B. All horizontal Gas Piping shall be pitched not less than 1/4 in. in 15 ft. to prevent traps. Pitch piping to risers. Install an 8 in. long sediment leg at the base of all risers. All changes in direction shall be made with plugged tees for cleaning piping out. All horizontal branch outlet pipes shall be taken from the top or side of horizontal mains and not from the bottom. Install shutoff valves for each battery of equipment and other valves as necessary to isolate any part of each system.

- C. Arrange with the Local Gas Company for the installation of the gas meters, services, and gas pressure regulators. Refer to DIVISION 01 - GENERAL REQUIREMENTS for information regarding Utility Company Charges.
- D. Plumbing Sub-Contractor shall furnish and install all gas vents for all knockdown regulators whether furnished by this Section, HVAC, or any other Section.
- E. Gas to the Emergency Generator shall be installed according to the following:
 - 1. A dedicated fuel line shall be installed for the Generator immediately downstream of the meter assembly.
 - 2. The fuel line for the Emergency Power Generator and the fuel line for the remaining appliances shall each have a separate shut off valve installed immediately downstream of the meter to enable each line to operate independently.
 - 3. The fuel line for the Emergency Power Generator shall be labeled at the shut off valve on each side of the wall it penetrates, floor, and every 10 ft. along its run with the following:

WARNING: Emergency Power Generator. Do not shut off without the approval of appropriate authorities.

1.20 SPECIAL WASTE AND VENT SYSTEM

- A. Furnish and install a complete Special Waste and Vent System to convey waste from all laboratory fixtures and equipment as shown on the Drawings and/or herein specified and in accordance with Code requirements. The system shall be a complete independent system, using corrosion resistant piping from a point 10 feet outside building, running through a neutralization system and terminating independently through the roof. Furnish and install Neutralizer and Ph monitor where shown.
- B. Piping shall be run as indicated on the Drawings, properly secured to the building structure with iron hangers. When any end circuit vent pipe from any fixture or line of fixtures is connected to a vent line serving other fixtures, the connection shall be sufficiently more above the floor on which the fixtures are located to prevent the use of the vent line as a waste (6 in. above flood rim of fixture).
- C. All changes in pipe sizes and direction on Special Waste lines shall be made with 'Y's and cleanouts, reducing fittings or recessed reducers. 'Y's and 45 degree fittings or 45 degree combination fittings shall be used wherever possible.
- D. All offsets shall be at an angle of not more than 45 degrees. All horizontal runs of 3 in. and smaller pipe shall have a pitch of 1/4 in. to the foot; 4 in. and larger pipe shall pitch at 1/8 in. to the foot.
- E. Sanitary long sweep bends shall be used for connections to branch lines for fixtures and TY's on vertical runs of pipe only. Long turn fittings shall be used wherever conditions permit. Furnish and install cleanouts at every change in direction of Special Waste lines and where indicated on the Drawings.
- F. All fixtures shall be separately trapped. All traps shall be vented unless otherwise indicated on the Drawings for fixtures in battery vent systems. Provide bow vents where island benches are not part of a battery system.

1.21 EQUIPMENT FURNISHED BY DIVISION 11

- A. Miscellaneous items, including but not necessarily limited to the following, shall be furnished and set by Division 11 and 12 as specified in other SECTIONS of the Documents.
1. Laboratory Equipment
 2. Laboratory Sinks
 3. Dishwashers
 4. Kitchen Equipment
 5. Toilet Sinks
 6. Waste and Gas Submeters
 7. Generators
 8. Refrigerators
- B. Verify the extent of the connection requirements from the General, Architectural, and Mechanical Plans and Specifications and be responsible for: Setting in place, all such sinks and furnishing and installing trim and roughing including, but not limited to, drains, vent, water, gas, air or other plumbing piping, traps, tailpiece, nipples, escutcheons, faucets, and stop valves for all items which above are not so supplied. The equipment sections specify sinks including faucets and tailpieces as well as countertop turrets for gas. Include for all sinks which are installed in cabinet work a pair of 1/2 in. ball valve stops (same as specified under 2.04) and a rough bronze p-trap, special waste trap, or sediment trap as required.
- C. Include a "Bakelight" stamped adhesive marker at each faucet indicating "Water Unsafe" as called for in 1.17 above.
- D. The Plumbing Subcontractor shall be responsible in making final connections to all equipment furnished by other Divisions, to ascertain complete cross-connection prevention compliance, and to furnish and install vacuum breaker and backflow preventers which may be required to be Code compliant and are not so furnished with the equipment.
- E. All sinks are intended to be "Accessible" and all drain outlets on all sinks and lavatories where furnished by the Plumbing Subcontractor or the other SECTIONS shall have an off-set drain. Set all roughing tight to wall in all cases to comply with ADA Standards. Provide where required ADA insulation kits to prevent injury where a barrier is not included in the casework. Refer to Equipment Drawings.

1.22 PAINTING

- A. All interior exposed piping is to be painted and all painting, except as noted, will be done by the Painting Subcontractor. All uncovered piping and hangers shall be thoroughly cleaned of rust, oil, and other containments by the Plumbing Subcontractor and left ready to receive primer coat.
- B. Painting for pipe markings shall be done under this Section.

- C. Painting of exterior gas piping at gas meter, generator, on roof, and at rooftop equipment, shall be done under this Section.

1.23 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by plumbing subcontractor, as specified under Section 01 50 00, TEMPORARY FACILITIES AND CONTROLS.

1.24 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, plumbing sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 01 50 00 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.25 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 01 91 13 – General Commissioning Requirements & Section – 22 08 00 Commissioning of Plumbing Systems.
- B. Complete installation and startup checks and functional tests according to Section 01 91 13 – General Commissioning Requirements,
- C. Operational Test: After plumbing systems have been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the startup procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113 and manufacturers written instructions/requirements.

1.26 BREAKDOWN

- A. Submit a breakdown of the contract price to aid the Architect in determining the value of the work installed as the job progresses.
- B. No requisition will be approved until the breakdown is delivered to the Architect.

1.27 VISIT TO SITE

- A. Prior to submitting a Bid, visit the site of work and become familiar with existing conditions. Any assumptions made are at Plumbing Subcontractor's expense.

1.28 ENERGY REBATE PROGRAM

- A. This project has been designed to incorporate equipment approved for energy rebate such as domestic water heaters. Provide actual equipment purchase price to owner to assist filling out forms for utility company rebates.

1.29 TRADE RESPONSIBILITY FOR INTERCONNECTIONS MATRIX

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Natural Gas Energy Sub-Meters	23 00 00	22 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	a.)
Domestic Water Sub-Meters	23 00 00	22 00 00	26 00 00 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	a.)
Boiler and Domestic Water heater Exhaust Breeching	22 00 00	22 00 00	N/A	N/A	N/A	b.)
Kitchen Emergency Gas Valve	22 00 00	22 00 00	26 00 00	26 00 00	N/A	
Electronic Trap Primer	22 00 01	22 00 01	26 00 00	N/A		
Lab utility solenoid control valve	22 00 01	22 00 01	26 00 00	N/A		

- a.) The control scope of work is solely to monitor and trending the unit output of the water and gas meter flow by ATC. Coordinate work in Division 23.
- b.) The control scope of work is solely to monitor and trending the operation/ status of water heater and recirculating pump is by ATC. Coordinate work in Division 23.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials and equipment furnished under this SECTION shall be new, unused, first quality of a manufacturer of established reputation. Each valve, fitting, section of pipe, and piece of equipment supplied to project shall have cast or indelibly stamped thereon the manufacturer's name, pressure rating where applicable, type, and any other specific information provided by manufacturer. Materials shall conform to Massachusetts Code as a minimum requirement and shall appear on the Massachusetts Approved Plumbing Products list.

2.2 PIPE AND FITTINGS

- A. Pipe and fittings shall conform to the latest A.S.A., A.S.T.M., C.A., and F.S. standards.
- B. All piping installed under this SECTION shall be in accordance with the following:

Service	Material
Underground Domestic Water Service	Class 52 cement lined ductile iron pipe
Underground Drainage and Vent piping	Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI). Cleanouts and joints just prior to exiting the building shall be service weight hub and spigot with lead and oakum joints.
Above ground Drainage and Vent, piping 2 in. and larger	No Hub cast iron soil pipe and fittings bearing collective trademark of the CISPI. Urinals joint connection shall be service weight hub and spigot with lead and oakum joints
Above ground drainage, and Vent piping 2 in. and smaller	Type 'L' hard tempered copper tubing
Trap primer piping from Primer to floor drain	Type 'K' soft rolled copper tubing with Swaged ends
Domestic water piping above ground (potable & non-potable Lab)	Type 'L' hard tempered copper tubing

Underground Storm Drainage piping	Service weight cast iron soil pipe-coated bearing collective trademark of the Cast Iron Soil Pipe Institute (CISPI). Cleanouts and joints just prior to exiting the building shall be service weight hub and spigot with lead and oakum joints.
Above ground Storm Drainage piping	No Hub cast iron soil pipe and fittings bearing collective trademark of the CISPI
Indirect waste piping	Type 'L' hard tempered copper tubing coated with two (2) coats of white epoxy paint
Acid Waste and Vent Piping above ground (Plenum rated)	Schedule 40 electric heat fused flame retardant Polyvinylidene Fluoride (PVDF) piping, PVDF fittings, Manufacturer "George Fischer, Orian, Enfield, Zurn or approved equal
Acid Waste & Vent Piping below ground	Schedule 40 electric heat fused non-flame retardant poly-propylene piping; fittings & traps,"George Fischer Fuseal", Orion, Zurn or equal
Gas piping above ground	Schedule 40 Black steel pipe,
Gas piping below ground	ASTM A-53 Schedule 40 black steel pipe with Factory-applied, three-layer coating composed of fusion bond epoxy, adhesive and polyethylene coating to minimum 3.0 mm thickness for corrosion protection.
Gas piping exposed in kitchen and at cooking island	ASTM A-53 Schedule 40 steel but painted with two (2) coats of white epoxy paint

- C. Fittings for underground Drainage Piping shall be service weight bell and spigot pattern C.I. soil pipe fittings. Above ground shall be no hub C.I. soil pipe fittings, Massachusetts Standard.
- D. Fittings for sweat drainage piping shall be cast bronze or wrought copper of recessed drainage pattern.
- E. Fittings for Type 'L' hard tempered copper tubing for potable and non-potable water piping 2-1/2 inch in size and smaller shall be copper press fittings.
 - 1. Acceptable Manufacturers:
 - a. Viega North America,
 - b. Ridge Tool Co.
 - c. Victaulic
 - d. Or equal

2. Material:
 - a. ASTM B88 and ANSI/ASME B16.22. O-rings for copper press fittings shall be EPDM.
 3. Installation of copper press fittings and installation are to be made in strict accordance with the manufacturers installation instructions. All tubing is to be reamed prior to the installation of the fitting. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
- F. Grooved joint piping systems for domestic water piping 3-inch and larger shall be installed in accordance with the manufacturer's guidelines and recommendations. All grooved couplings, fittings, valves, and specialties shall be the products of a single domestic manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be supplied by the manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. A factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools and installation of grooved piping products. Factory trained representative shall periodically review the product installation. Contractor shall remove and replace any improperly installed products.
- G. Fittings for polypropylene acid-waste and acid vent (special waste system) shall be Schedule 40 PVDF fittings with electrical resistance heat fusion joints as manufactured by George Fischer, Orion, Zurn, or equal. All underground pipe and fittings shall be bedded, jointed, backfilled with materials and methods outlined by the manufacturer's published instructions.
- H. Fittings for compressed air piping shall be threaded malleable iron air pattern fittings for screwed pipe.
- I. Fittings for gas piping 2-inch and smaller shall be threaded malleable iron gas pattern fittings for screwed pipe. All gas piping 2 ½ inch in size and larger shall be welded and shall utilize butt welded steel pipe fittings.
- J. Fittings for underground domestic water service shall be 250 psi gray iron cement lined fittings with mechanical joint ends.
- K. Provide cathodic protection for underground gas piping.

2.3 JOINTS

- A. Joints for underground cast iron bell and spigot soil pipe shall be made up with resilient gaskets. Above ground shall be made up of heavy duty – 4 band stainless steel clamps, and gaskets. Couplings shall be in compliance with CISPI 310 and shall bear the mark of NSF International. Couplings shall be Husky "SD 4000", Clamp - All HI-TORQ 125, Mission "HW", or equal.

- B. Copper water tubing and fittings shall be assembled with press or grooved fittings depending on pipe size.
- C. Copper waste and vent tubing with sweat fittings shall be assembled with lead free solder, Silverbrite, Oatey, Harris, or equal, and a non-corrosive flux recommended by the manufacturer.
- D. Joints between copper waste/vent tubing and cast iron shall be made with cast iron threaded fittings and copper thread by sweat fittings.
- E. Joints between copper tubing and ductile iron water pipe or at flanged joints to tanks shall be made with a combination iron and brass flange with composition gasket and iron bolts.
- F. Joints at water heaters or other tanks having threaded connections shall be made up with dielectric unions.
- G. Joints between floor or wall flanges and fixtures shall be made with one-piece special molded neoprene gaskets which shall be furnished by the fixture manufacturer.
- H. Threaded pipe joints including plastics shall be made up with teflon tape.
- I. Joints on screwed gas piping shall be made up with thread compound on male threads only. Welded joints shall be made up by certified welders. All joints on piping 2-1/2 in. and larger, and on emergency generator exhaust regardless of size shall be welded.
- J. Joints on acid waste and vent up to the outlet side of all traps shall be made up with electrical resistance fused joints utilizing manufacturer supplied power unit. Slip joints shall be used only in the final makeup connection between the trap and sink tailpiece. Vertical risers shall have vertical expansion joints at 20 ft. intervals. Horizontal runs shall have expansion joints in accordance with manufacturer's recommendations.

2.4 VALVES

- A. Furnish and install valves where indicated on the Drawings or where specified and located so that they may be operated, repaired, or replaced with a minimum effort and repacked under pressure.
- B. Gas Valves Interior
 - 1. Ball Valves: Ball valves shall be the fire seal type, conforming to UL 842 and UL 125.
 - 2. Valve bodies in sizes 1-inch ips and smaller shall be screwed end type constructed of ductile iron, carbon steel, or cast steel.
 - 3. Valve bodies in sizes 2-inch ips and larger shall be flanged end type constructed of ductile iron, carbon steel, or cast steel unless otherwise specified
 - 4. Valve bodies shall have socket weld ends or butt weld ends were indicated to be welded, and body shall be constructed of carbon steel or cast steel.
 - 5. Balls and stems shall be Type 316 corrosion-resistant steel.
 - 6. Valves shall be suitable for flow from either direction and shall seal tightly

- in either direction.
7. Eccentric Plug Valves: Eccentric plug valve maximum size shall be limited to 3-inch ips.
 8. Eccentric plug valves shall be constructed with the semi-steel body, bronze plug with Buna N resilient elastomer seals. Body sealing face shall be plastic coated.
 9. Body end connection shall be screwed for sizes 1-inch ips and smaller and flanged in sizes through 3-inch ips.
 10. Plug shall be top and bottom guided by oil-impregnated bronze bushings and shall be corrosion resistant steel spring-loaded.
 11. Valves shall be rated at 175 psi WOG and shall be UL listed for natural gas service.
 12. Lubricated Plug Valves: Valves shall be Type 1, Style A or B, taper plug type, rated for not less than 175 psi WOG service and shall conform to MIL V 12003.
 13. Valves may be cylindrical plug type, constructed to service pressure and materials requirements specified for taper plug valves; in addition, clearance between plug and body sealing surfaces shall not exceed 2 mils for valves to 2 inch ips and shall be 3 to 5 mils for larger valves; plug stem seal and bottom support shall be reinforced tetrafluoroethylene; plug shall be bottom spring-loaded.
 14. Regulator bypass valves shall be provided with proportioning ports and locking feature.
 15. Valves shall be provided with screwed end connections for all sizes 1-inch ips and smaller and flanged end connections for all larger valves.
 16. Solenoid Valves: Aluminum body, 120 volts AC, 60 HZ, Class B continuous duty modeled coil; NEMA 4 coil enclosure; electrically opened/electrically closed; dual coils; normally closed; UL and FM approved and labeled.
 17. Gas Line Pressure Regulators: Single-stage, steel jacketed, corrosion-resistant gas pressure regulators; with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends for 2-1/2 inch and larger; for inlet and outlet gas pressures, specific gravity, and volume flow indicated.
 18. Emergency gas shut off valve shall be Massachusetts State approved.
 19. Gas service fire valve,(equal to OMCO inner tite specialty products), to be installed on the gas piping immediately after the gas company meter, but inside the building shall be a flanged end, fusible plug type, automatic acting over-temperature fire valve. The valve shall conform to MSS-SP-71 Type-1 and ANSI B16.10 & B16.1
 20. Piping, trenching and corrosion protection for underground gas piping shall be the same system being specified by the local gas company.

C. The following list of valves is intended only as a guide for type and quality. Valves shall be as manufactured by Apollo, Milwaukee, Nibco, Elkhart, Watts or approved equal.

Shutoff valves

Apollo #94VLF-A
lead-free ball valves

Balancing valves

Bell & Gossett Model CB lead free
calibrated balance valve.

Gate valves 4 in. and larger	Jenkins 651-A
Stop and waste valves 1 in. and smaller	Apollo #95LF-203 through #95LF-205, lead-free
Check valves	Walworth #406 SJ
Drain valves	Apollo #77WLF-HC ball valve with cap and chain 1/2 in. x 3/4 in. hose end
Backwater Valve (Drainage Systems)	Zurn #Z1095. At below grade installations provide with extension to grade Zurn model Z1095-FC, height as required.

2.5 PIPE COVERING (INSULATION)

A. General

1. The pipe covering specified herein for piping system shall be provided to strict accordance with the manufacturer's printed instructions, the best practice of the trade and to the full intent of this Specification.
2. Flame/Smoke Ratings: Provide complete fibrous glass pipe insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame spread index of 25 or less, and smoke developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.
3. Manufacturer: Subject to compliance with requirements, provide products of Johns Manville "Micro-Lok HP", Knauf Fiber-Glass, Owens Corning or approved equal.
4. Apply insulation after systems have been tested, proved tight and approved by Designer. Remove dirt, scale, oil, rust and foreign matter prior to installation of insulation.
5. No leaks in vapor barrier or voids in insulation will be accepted.
6. Insulation and vapor barrier on piping which passes through walls or partitions shall pass continuously through sleeve, except that piping between floors and through fire walls or smoke partitions shall have space allowed for application of approved packing between sleeves and piping, to provide fire stop as required by NFPA. Seal ends to provide continuous vapor barrier where insulation is interrupted.

B. Interior Cold, and Hot Water Recirculation pipe insulation:

- 1 One insulation for all CW and HWR pipe sizes. ASTM E-547, Class I

C. Hot Water Supply, 140°F Hot water Supply, Heat Traced piping.

- 1 One thick insulation for pipe sizes less than pipe size 1.5" and 1.5" thick insulation for pipe sizes equal and greater than pipe size 1.5". ASTM E-547, Class I
- 2 Fire retardant foil face jackets for piping insulation: ASTM C-921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at installation option.
- 3 Horizontal Rain water conductors, Overflow drain pipe and waste piping, including underside of drain bodies and vertical drops from drains to offset and elbow at the end of the horizontal run, 1" thick with vapor barrier. Concealed conductor piping, including drains (roof boxes) shall be insulated with two layers of vapor barrier blanket, 1" thick, minimum one pound density.
- 4 Encase pipe fittings insulation with one piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- 5 Encase exterior piping insulation with 0.016" thick aluminum jacket with weatherproof construction.
- 6 Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- 7 Provide product document submittals according to the LEEDv4-S rating system. The product must achieve IEQ Credit 2 Low emitting Materials rating requirement.

2.6 TRAPS

- A. Furnish and install traps with cleanouts on all fixtures and equipment requiring connection to the sanitary system of the same size and material as the pipe on which they occur. Traps installed on threaded pipe shall be recessed drainage pattern.
- B. Traps for the special waste system shall be Sloan polypropylene 'P' traps to suit installation. Traps shall be one-piece or shall utilize electric resistance connection. All traps shall be fitted with a cleanout plug.

2.7 DRAIN VALVES

- A. It shall be possible to drain the water from all sections of the Potable and Non-Potable Hot and Cold Water Piping. Furnish and install 1/2 in. x 3/4 in. hose end ball valves with cap and chain. (see 2.04 for model no.)

2.8 SHOCK ABSORBERS

- A. Furnish and install, where shown on Drawings and where required to prevent water hammer, Zurn Manufacturing Company model 1250-XL lead free shock absorbers, or equal, as manufactured by J.R. Smith Manufacturing Company, Josam Manufacturing Company, or equal.
- B. Installation of absorbers shall be as per manufacturer's recommendations.

2.9 PIPING ACCESSORIES

- A. Pressure and Temperature Relief Valves shall be A.S.M.E. rated temperature relief 210 deg. F. double BTU rated, self-closing, as manufactured by Watts Regulator Company or equal by Wilkins, McDonnell and Miller, or equal.
- B. Vacuum reliefs shall be lead free Watts Regulator Company #LFN36 or equal by Wilkins or Lawler.
- C. Temperature gauges shall be 4-1/2 in. diameter dial thermometers, any angle, and range of 30 degrees F. to 240 degrees F. as manufactured by Weiss Instruments, U.S. Gauge, Terrice or equal.
- D. Potable and non-potable Water system pressure gauges shall be 4-1/2 in. diameter with a range of 0 to 160 psi as manufactured by Weiss Instruments, U.S. Gauge, Terrice or equal.
- E. Natural gas system pressure gauges shall be 4 inch diameter with a range of 0 to 30 inches of water as manufactured by Weiss Instruments, U.S. Gauge, Terrice or equal.
- F. Furnish and install where piping crosses building expansion joints on the domestic water piping and gas piping, expansion joints and anchors sized for 1-1/2 in. expansion per one hundred feet. Expansion joints shall be Metraflex "Metraloop", or manufactured by Flexonic Company or Hyspan, or equal. Piping shall be anchored and guided to force the expansion in the proper direction. Domestic water expansion joints shall be NSF approved. Gas expansion joints shall be AGA approved.
- G. Furnish and install where indicated on Drawings, Watts Regulator Company lead free pressure reducing valve and strainer combination size as indicated on the Drawing or equal, as manufactured by Donnelly Products Company or McDonnell and Miller.
- H. Trap primer connections are required on all floor drains to maintain trap seal. The requirement for trap primer connections shall include all floor drains in the kitchen including trough drains furnished under Division 11. Trap primers shall be as paragraph 2.23. Furnish distribution units as required.

2.10 HYDRANTS AND HOSE BIBB

- A. Frost Proof Hose Bibb (FPHB) shall be Zurn Series Z-1310-PB Ecolotrol cast brass 3/4 in. non-freeze wall hydrant with integral backflow preventer, 3/4 in. hose connections, polished nickel bronze face, loose key handle, brass wall sleeve, and fitted with brass locknut.

- B. Hose bibb (HB1) shall be T & S Brass or equal model #B-720 modified, chrome plated, 3/4 in. hose end, integral stop, vacuum breaker, modified with lock shield and loose tee handle.
- C. HB2 (as indicated on the kitchen plans) Full flow in-line vacuum breaker with hose thread outlet, 2" vandal-proof handle, slow compression operating cartridge and 3/4" NPT female inlet. Equal to Chicago No. 387-E27CP, Josam, Watts.
- D. Hydrants shall be manufactured by Zurn, J.R. Smith, Josam, or equal. Hose bibbs shall be manufactured by T&S Brass, Speakman, Chicago, or equal.

2.11 CLEANOUTS

- A. Cleanout plugs on the Sanitary System shall be of heavy cast brass of the screwed type. Plugs shall be full size up to and including 4 inch.
- B. For piping running under floor slab, cleanouts shall be brought up to just under the floor slab level. Furnish and install access cover for all floor-type cleanouts, Zurn ZN-1400 Series with scoriated nickel bronze or by Josam, J.R. Smith, or equal. In the garage area and at exterior locations use Zurn model #Z-1474 cleanout housing set over brass cleanout plug.
- C. Cleanouts for Special Waste System shall be as follows:
 - 1. On polypropylene pipe, use Zurn #Z9A-C04 polypropylene cleanout plug.
 - 2. Below floor - Bring cleanout plug to below floor level and use Zurn #ZANB-1463-VP nickel bronze scoriated floor access cover mounted on Shamrock Industries concrete sleeve. See detail on drawings.

2.12 ACCESS DOORS

- A. Furnish Access Doors for access to all concealed control valves, cleanouts, valves, expansion joints, and to all other concealed parts of the Plumbing System that require accessibility for the proper operation and maintenance of the system. These doors shall be installed under the appropriate SECTION of the Specifications as determined by the surface upon which the panels are mounted.
- B. All Access Doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the valve or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. x 16 in.). Furnish Access Doors for each pipe space to permit thorough inspection of same. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.
- C. Access doors shall be prime painted and completed with cylinder lock and two (2) keys as manufactured by Acudor, Inland Steel Products Company "Milcor", or Walsh-Hannon-Gladwin, Inc., "Way Loctor". Type shall be as follows:
 - 1. Acoustical Tile Ceiling Acudor AT-5020
 - 2. G.W.B. Surfaces Acudor DW-5040
 - 3. Masonry Construction Acudor UF-5000
 - 4. Fire Rated Construction Acudor FB-5060

- D. Access Door Shop Drawings shall be submitted to the Architect for approval.

2.13 SUPPLEMENTARY STEEL, CHANNEL, AND SUPPORTS

- A. Furnish and install all supplementary steel, channels, and supports required for the proper installation, mounting, and support of all equipment.
- B. Supplementary Steel and Channels shall be firmly connected to building construction in a manner approved by the Architect.
- C. The type and size of the Supporting Channels and Supplementary Steel shall be determined by the Plumbing Subcontractor and shall be sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.
- D. All Supplementary Steel and Channel shall be installed in a neat and workmanlike manner parallel to the walls, floor, and ceiling construction. All turns shall be made with 90 deg. fittings, as necessary to suit the construction and installation conditions.

2.14 HANGERS, ANCHORS, GUIDES, AND PIERS

- A. All piping shall be supported from the Building Structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration, and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.
- B. The spacing for hangers for horizontal piping shall be in accordance with the following:
1. Cast Iron Soil Pipe: 5 ft.-0 in. at the hubs for 5 ft. lengths. For 10 ft. lengths, use one (1) hanger at the hub and one (1) at midpoint of the length. Install cast iron pipe in accordance with CISPI Handbook - latest edition.
 2. Copper Tubing: 6 ft.-0 in. o.c. for 1-1/4 in. and smaller, and 10 ft.-0 in. o.c. for 1-1/2 in. and larger.
 3. Steel Pipe: 10 ft.-0 in. o.c. for 1-1/2 in. and over; 8 ft. - 0 in. for 1-1/4 in.; 6 ft. - 0 in. for 1 in. and smaller.
 4. Polypropylene acid waste: 4 ft.-0 in. o.c.
- C. Hanger rod diameter shall be as follows:

Pipe Size	Rod Diameter
1/2 in. thru 2 in.	3/8 in.
2-1/2 in. and 3 in.	1/2 in.
4 in. and 5 in.	5/8 in.
6 in.	3/4 in.
8 in. and over	7/8 in.

- D. Vertical lines shall be adequately supported at their bases by a suitable hanger placed in the horizontal line near the riser and at every 10 ft. interval.
- E. All Hangers (including those for acid-waste) shall be adjustable Clevis Hanger. Hanger rods shall have machine threads. Malleable iron brackets of approved type shall be used along the walls. All Hangers for copper tubing shall be copper plated except where pipe is insulated, in which case, Steel Clevis Hanger and pipe shield shall be used.
- F. Piping shall not be hung from the hangers of other trades.
- G. Hangers shall be manufactured by Grinnell, Carpenter and Paterson, Fee and Mason, or equal.
- H. Wire and strap hangers will not be permitted in this installation.
- I. Install a 14 gauge metal pipe shield between pipe insulation and all pipe hangers. Hangers shall be sized so that the pipe insulation passes through the hanger and is supported on the shield.

2.15 DRAINS

- A. Furnish and install all floor drains and roof drains where shown on the Drawings.
- B. All floor drains in flooring systems without waterproofing membranes shall have galvanized iron clamping rings with 6-pound lead flashing to bond 9 in. in all directions. All drains shall be checked with Architect's Drawings to determine depth of the flashing collar. Brass extension pieces shall be provided if necessary.
- C. All floor drains installed on this project shall be fitted with Automatic Trap Primer Connections. Field determine appropriate location for Trap Primer valve and drain piping.
- D. Floor Drain Schedule:
 - 1. Type "A" – Zurn #ZN-415-5BZ-P dura coated cast iron body with bottom outlet, combination invertible membrane clamp, adjustable collar, seepage slots, type BZ polished nickel bronze, light-duty, leveling strainer, trap primer connection.
 - 2. Type "B" – Zurn #Z-550-Y-P, 9 in. diameter top, dura coated cast iron body bottom outlet, seepage pan, combination membrane flashing clamp, frame for medium-duty, cast iron, heel-proof slotted grate, sediment bucket, cast iron grate, trap primer connection
 - 3. Type "C" - Floor Drain (Labs) shall be corrosion resistant floor drain manufactured from fire retardant polypropylene material conforming to ASTM D 4101, Grate, plug and covers made from fiber filled polypropylene for strength and durability. Floor drain shall be equal to Orion AWF DSTD.
 - 4. Type "D" - Zurn #Z-512-G-Y-VP Galvanized heavy duty cast iron body sediment bucket, heavy duty ductile iron secured grate, caulk bottom outlet.

5. Type "E" (Kitchen) shall be equal to Jay R. Smith Figure #3020, 8.5" dia. round grate and dome strainer. All Galvanized receptor, Nickel Bronze Rim and 4" dia. NB funnel.
- E. Floor Sink (FS1- Kitchen) shall be equal to Jay R. Smith Figure #3002-12 "square with grate and dome strainer. 14 gauge Type 304 SS Receptor Body with Seepage Control holes, Cast type 316 SS Ribbed non-tilt loose set grade w/ 1/2" holes. Provide floor drain w/ perforated SS dome bottom and trap primer connection. Coordinate and provide funnel or 3/4" grate as required.
- F. Roof Drain (RD-1): Zurn #ZC-100-DP-EA-G, galvanized cast iron body roof drain, under-deck clamp, galvanized cast iron dome secured, cast iron extension, roof sump receiver. Refer to Architect's Drawings for height of insulation
- G. Trench Drain (TD-1): 12" wide top modular trench drain, Dura coated cast iron deep sump body with bottom outlet and stainless steel top. Provide long outlet module and extension modules complete with integral seepage pan and heavy duty, Heel Proof grate. Provide sediment bucket and vandal proof secured top. The trench drain shall be equal to Zurn 665.
- H. Drains shall be of one manufacturer, by Zurn, J.R. Smith, Josam, or equal.
- I. In bathrooms, coordinate all floor drain locations in field with Architect. Drain locations shall not conflict with toilet partition walls.

2.16 PLUMBING FIXTURES

- A. Furnish and install all fixtures and equipment, including supports, connections, fittings, and any incidentals, to make a complete installation in accordance with the Drawings and as specified.
- B. The Architect shall be final judge as to whether fixtures and trim fulfill the requirements of the Specifications and as to whether they are of suitable quality.
- C. All fixtures requiring hot and cold water shall have the cold water faucet on the right hand side of the fixture and the hot water faucet on the left hand side of the fixture.
- D. Escutcheons shall be furnished and installed on all supplies and traps. Escutcheons shall be one (1) piece chrome plated brass with set screws.
- E. All fixtures shall have the manufacturer's guaranteed label or trademark indicating first quality. All acid resisting enameled ware shall bear the manufacturer's symbol signifying acid resisting material.
- F. Unless otherwise specified, faucets and all exposed fittings shall be chromium plated.
- G. All supply pipes shall run in a reasonable straight vertical line from the stops to faucets. Traps shall be installed perpendicular to walls.
- H. Note: All fixtures and fittings shall be vandal proof mounted, unless specifically noted otherwise.

- I. Carefully coordinate roughing for flush valves so that the dimension from top of fixture to C-L of flush valve is a minimum of 6 in.

- J. In general, the work of this Article shall include, but not be limited to:
 - 1. Plumbing fixtures and trim.
 - 2. Faucets and flushometers.
 - 3. Stops and supplies.
 - 4. Traps and tailpieces.
 - 5. Drain outlets.
 - 6. Mixing valves.
 - 7. Shower assemblies.
 - 8. Flow controls.
 - 9. Carriers and supports.
 - 10. Lavatory insulators.

- K. Fixtures and Trim
 - 1. Acceptable Manufacturers: Submit manufacturers not listed below for review and approval as specified for substitutions in this Section.
 - a. Vitreous China: Eljer, American Standard, Crane, Kohler or equal.
 - b. Molded Composite Lavatories: Bradley, Intersan or equal
 - c. Faucets: Chicago Faucet Co., Kohler or T & S Brass or equal.
 - d. Self Closing Faucets: Chicago Faucet Co., Sloan, Kohler, Symmons or equal.
 - e. Sensor Faucets: Chicago Faucet Co., Hydrotek, Sloan or equal.
 - f. Stainless Steel Sinks: Elkay, Just Manufacturing, Metcraft Inc or equal.
 - g. Mop Service Basins: Crane, Fiat , Stern Williams or equal.
 - h. Carriers and Supports: Jay R. Smith, Wade, or equal.
 - i. Thermostatic Mixing Valves: Leonard Valve Co., Powers Process Controls, Symmons, Chicago Faucets or equal.
 - j. Pressure Regulating Mixing Valves: Lawler Manufacturing, Leonard Valve Co Symmons or equal.
 - k. Shower Enclosure: Aquatic, Aquarius, Clarion or equal
 - l. Shower Head: Symmons, American Standard Kohler or equal
 - m. Water Fountain: Haws, Halsey Taylor, Filtrine or equal.
 - n. Trench Drains: MiFAB, Jay R Smith, Watts
 - o. Flush Valves: Sloan, American Standards, Hydrotek or equal.
 - p. Stops and Supplies: Chicago Faucet Co., Kohler or McGuire.
 - q. P-Traps: McGuire, Sanitary-Dash, or Jameco.
 - r. Handicap Lavatory Insulation: McGuire, TCI Products or Truebro.

 - 2. Fixture Trim and Accessories: Provide fixtures complete with floor mounted fixture carrier supports; faucets, flushometers; drain outlets, tailpieces, P-traps and stops and supplies.
 - a. Color and Finish: All trim exposed to view shall be polished chrome plated, and all fixtures and toilet seats shall be white unless specified otherwise.

- b. Drain Outlets: Provide drain outlet of the same manufacturer as the fixture or faucet trim with chrome plated 17 gauge minimum weight tailpiece.
 - 1) Provide 1-1/4 inch tailpiece on lavatories.
 - 2) Provide 1-1/2 inch tailpiece on sinks.
 - 3) Provide offset drain outlets on handicapped use lavatories and sinks.
3. P-Traps: Cast brass adjustable P-trap with cleanout plug, ground joint and 17 gage minimum weight extension with escutcheon.
 - a. Provide McGuire No. 8090 1-1/4 inch by 1-1/2 inch on lavatories.
 - b. Provide McGuire No. 8089 1-1/2 inch by 1-1/2 inch on sinks.
4. Stops and Supplies: Provide stops and supplies of the same manufacturer as the fixture or faucet trim, or provide McGuire Model 170-LK loose key angle stop with 5 inch long 2 inch nominal copper sweat extension, bell escutcheon, and 3/8 inch O.D. by 12 inch flexible riser.
5. Sinks: Seamlessly drawn, self-rimming minimum 18 gauge, type 302 (18-8) nickel bearing stainless steel with 1-3/4 inch minimum rounded corners, satin finish, and fully undercoated.
6. Faucets: Chrome plated cast brass with stainless steel seats and monel stems. Gooseneck spouts shall be interchangeable and convertible rigid/swing type. Handles shall be interchangeable with square handle broachings.
7. Flushometers: Diaphragm operated cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, screwdriver check stop, vacuum breaker. The flush valve shall be electric sensor operated with true manual override feature.
8. Water Conservation: Provide water conserving fixtures (water sense labeled) and trim in compliance with the following maximum water use requirements. Provide Omni or equal variable pressure flow controls on sinks, and lavatory faucets.
 - a. Public lavatories: 0.35 gpm
 - b. Sinks: 1.5 gpm
 - c. Water Closets: 1.28 gallons per flush.
 - d. Urinals: 0.125 gpf
9. Fixture Supports: Provide floor mounted fixture support carriers for wall mounted fixtures including but not limited to: water closets, lavatories, scrub sinks, urinals, and clinical sinks.
10. Fixture carriers shall support at least 250 pounds on the front rim of the fixture for 5 minutes.

- a. Water Closets: Jay R. Smith Series 200-Y
 - b. Urinals: Jay R. Smith 637.
 - c. Lavatories: Jay R. Smith 700-M31.
 - d. Wheel Chair Lavatories: Jay R. Smith 700-27-M31.
11. Toilet Seats: Provide extra heavy-duty, commercial/industrial type, elongated, open front, solid white injection molded plastic with integral bumpers; and self sustaining stainless steel check hinges.
- a. Acceptable Manufacturers: Bemis, Beneke, or Church.
12. Handicap Lavatory and Sink Insulation: Shall be provided on water supplies and waste piping below handicapped use lavatories and sinks.
- a. Acceptable Manufacturers: McGuire, TCI Products or Truebro.

L. Fixture Description

- 1. P-1 HET Water Closet, Equal to American Standard Model Afwall Millenium 2859. Vitreous china wall hung, white, elongated wall outlet water closet, 1.1 GPF, 1-1/2" top spud. Toilet flush valve to be water sense labeled, Manual 1.28 gpf flushometer. Equal to American Standard 6047.111.002. Provide combination drainage fitting and chair carrier to suit. Extra heavy duty solid plastic seat with check hinges (open front). Water closet shall be in compliance to the applicable section of ASME A112.19.2/ CSA B45.1
- 2. P-1A Water Closet (Barrier Free) Same as P-1, except mounting in accordance with architectural barriers board.
- 3. P-2 Urinal: Wall hung, 0.125 gpf vitreous china, top spud urinal equal to American Standard model Maybrook Universal 6581.00EC. The Flush valve to be water sense labeled, manual 0.125 gpf equal to American Standard 6045.013.002.
- 4. P-2A Urinal (Barrier Free) Same as P-2, except mounting in accordance with architectural barriers board.
- 5. P-3: The Lavatory shall be integral to the countertop casework under Division 11. Plumbing contractor shall provide deck mounted sink faucet for hot and cold water, metering faucet, (lead free), Water Sense, 0.35 gpm aerator, adjustable 8" centers, chrome plated, vandal proof, push handles with blue and red index buttons, MVP self closing, auto timed metering cartridge. Faucet to be ADA compliant shall be equal to Chicago Faucets 404-HZV665E39ANCP. Provide Trim Plates, Chrome Plated brass grid strainer, flexible stainless steel hoses to allow handle placement. Coordinate mounting location with countertop. Provide point of use thermostatic mixing valve, Conceal all exposed roughing under lavatory with Truebro Lav Guard2 #103 E-Z insulation kit.

6. P-3A : American Standard Murro Universal Design 0954.00 wall hung lavatory, ASME A112.19.2; vitreous china, wall hung wheel chair lavatory, 22" deep x 21.25" wide with 4" center faucet hole, Bowl size 15.5"x13.5"x 5", concealed arm brackets. Deck Mounted 4" fixed centers metering faucet, (lead free), 0.35 gpm aerator. Faucet to be equal to Chicago Faucets Model 3500-4E39PABCP. Provide Trim Plates, Chrome Plated brass grid strainer w/ 1 ¼ outlet tube. Mounting height in accordance with architectural elevation drawing. Provide knee guard insulation kit for trap and supplies.
7. P-4: Equal to Filtrine Model 107-16-HL-VP, vandal proof, wall mounted, high/low circular drinking fountain with vandal proof bubbler, security panel and bottle filler. Receptors shall be 16 in. diameter with 3/8 in. radius edges. Fountain, cover plate and bubbler to be 16 gauge steel with #4 Satin stainless steel finish. Low fountain location shall be on left. Include option for 1'-6" high access panel located below unit. Mount fountain per architect's direction. 1-1/4 in. x 1-1/2 in. rough p-trap with cleanout; 1/2 in. ball valve stop. Provide 3-spare filters.
8. P-5 Floor Service Sink: Mop Receptor Fiat precast terrazzo mop basin, 24" x 24" x 12" with 6" drop front, stainless steel threshold, flange on wall sides. Fiat Model TSB-3010. Chicago 897 wall mounted service sink faucet w/ vacuum breaker spout. Wall hook, 24" long mop hanger with 3 spring clips. Provide 6' stainless steel braided water supply hose with pressure bleeder device and dual vented check valve (ASSE1055B approved) for secondary back flow preventer to soap dispenser connection. Installation shall be as per the plumbing code requirement.
9. P-5A Wall Hung Utility Service Sink : Equal to American Standard Model # 7695.018, Enameled cast iron, 24" X 20-½" complete with rim guard, drilled back on 8" centers and #7798.176 P-trap, 3" outlet, floor support with strainer. Faucet shall be equal Chicago Model 956-RCP with #369 lever handle, 8" centers with vacuum breaker.
10. P-6 Shower: Shower shall be equal to Praxis. Finished surface shall be of a sanitary grade polyester gelcoat, exhibiting a minimal thickness of 15 dry mills. The unit shall have outside dimensions of 36" x 36" x 72".

The shower shall be equal to Symmons Temptrol Shower unit with hand spray model S-96-600-B30-L-V. Other approved manufacturers are Kohler, American Standard and Crane. Pressure balancing mixing valve, attached soap dish. Provide shower drain.

11. P-6A Shower: Shower shall be equal to Praxis. Finished surface shall be of a sanitary grade polyester gelcoat, exhibiting a minimal thickness of 15 dry mills. The unit shall have outside dimensions of 36" x 60" x 72".
Unit shall have a ¾ in. threshold to meet MAAB requirements. Shower enclosure shall have fold-up cushioned seat and factory grab-bars to comply which MAAB requirements.
The shower shall be equal to Symmons Temptrol Shower unit with hand spray model S-96-600-B30-L-V. Other approved manufacturers are Kohler,

American Standard and Crane. Pressure balancing mixing valve, attached soap dish. Provide shower drain.

12. P-7 SCIENCE CLASSROOM SINK:

Plumber shall furnish and install a faucet. Plumber shall install the sink outlet and drain fitting. Sink shall be furnished by the case work under Division 12. Contractor shall make rough and final connections of water, waste and vent.

Chicago No. 786-GN8BV-E7FC-CP-369 concealed deck faucet with 8 in. gooseneck spout, vacuum breaker, 2-3/8 in. wrist blade handles, E7FC 0.74 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper. 1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons.

13. P7A SCIENCE CLASSROOM SINK (BARRIER FREE):

Plumber shall furnish and install a faucet. Plumber shall install the sink outlet and drain fitting. Sink shall be furnished by the case work under Division 12. Contractor shall make rough and final connections of water, waste and vent.

Chicago No. 786-GN8BV-E7FC-CP-369 concealed deck faucet with 8 in. gooseneck spout, vacuum breaker, 2-3/8 in. wrist blade handles, E7FC 0.74 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper.

1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons. Conceal all exposed roughing under sink with Truebro Lav Guard2 #103 E-Z insulation kit.

14. P-8 Classroom Sink

Elkay DRKR-ADA-1725, modified #18 ga. type 304 stainless steel, self-rimming, counter mounted sink modified with three (3) hole punching on right ledge, single hole on left ledge, 5-1/2 in. deep, centered rear drain opening, for 3-1/2 in. drain, ADA compliant, overall dimensions 17 in. x 25 in. x 5-1/2 in. deep bowl. Non abrasive sound deadening on underside.

Chicago #201A-GN8A-E2805-369 concealed deck faucet with 8 in. swing gooseneck spout, 2-3/8 inch wrist blade handles, E-2805 0.5 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper. 1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. ball valve stops and escutcheons.

Conceal all exposed roughing under sink with Truebro Lav Guard2 #103 E-Z insulation kit.

15. P-9 (Art Room)

Elkay ELUH211510PD single bowl, 21 in. x 15 in. x 10 in. deep, under-counter mounted, 18 GA type 304 stainless steel sink with offset rear outlet; coordinate three (3) hole punching for sink with Architectural millwork, sound deadening underside.

Chicago No. 201A-GN8A-E2805-5CP-317 concealed deck faucet with 8 in. swing gooseneck spout, 4 in. wrist blade handles, E-2805 0.5 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons. Zurn No. Z-1180 acid-resistant interior and exterior fabricated steel solids interceptor mounted on floor tight to wall. (Rough as tight to the wall as feasible). Provide point of use thermostatic mixing valve equal to Chicago Faucet model 131-CABNF

16. P-9A: (Art Room Sink-Barrier Free)

Elkay ELUHAD211555PD single bowl, 21 in. x 15 in. x 5-1/2 in. deep, under-counter mounted, 18 GA type 304 stainless steel sink with offset rear outlet; coordinate three (3) hole punching for sink with Architectural millwork, sound deadening underside.

Chicago No. 201A-GN8A-E2805-5CP-317 concealed deck faucet with 8 in. swing gooseneck spout, 4 in. wrist blade handles, E-2805 0.5 GPM aerator. Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper.

1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons. Conceal all exposed roughing under sink with Truebro Lav Guard2 #103 E-Z insulation kit.

Zurn No. Z-1180 acid-resistant interior and exterior fabricated steel solids interceptor mounted on floor tight to wall. (Rough as tight to the wall as feasible). Provide point of use thermostatic mixing valve equal to Chicago Faucet model 131-CABNF

17. P-10: Emergency Shower/Eyewash (Science Classrooms):

Product shall be equal to Guardian GBF2152 emergency shower with ADA compliant swing activated eyewash system. Chrome plated shower head shall be mounted 96" above finish floor on 1" NPT chrome plated brass nipple. 1" NPTF chrome plated brass stay-open ball valve. Stainless steel triangular pull handle. Pull rod length shall be modified to accommodate varying ceiling heights. The integral eyewash shall be within stainless cabinet and activates automatically as the spray arms are pulled downward. Provide flow switch to interface with BMS. See specification TM2 on paragraph 2.21 for thermostatic mixing valve.

18. P-10A: Pedestal mounted eyewash with ABS plastic bowl, Schedule 40 galvanized pipe and fittings, 1/2" U.S. made chrome-plated stay-open ball valve, powder-coated cast aluminum flag handle and floor flange. Unit shall have (2) polypropylene GS-Plus™ spray heads with integral "flip-top" dust covers, filters and 1.6 GPM flow control orifices mounted on a chrome-plated brass eyewash assembly. Unit shall include Thermostatic Mixing Valve (TM2A) as specified in 2.21 paragraph. ANSI compliant sign. Unit shall be hydrostatically tested to meet or exceed ANSI Z358.1 – 2014. Product shall be equal to Guardian Equipment G1825P.

19. P-11 : Fume Hood Service Connection

Plumber shall provide cold water w/ vacuum breaker, gas, acid waste /trap and vent connection as per the manufacturer's instruction.

20. P-12 Valve Outlet Box

a) P-12A Laundry Box: Laundry box (Metal) shall be fire rated equipped with hose bib outlet connections with hammer arrester, no lead valves and 2" drain connection. Laundry box shall be equal to IPS -FR-12. Other acceptable manufacturer Watts, Sioux or approved equal.

d) P-12B Ice maker valve outlet: Furnish and install Fire Rated icemaker outlet Box with CSA listed, 1/2" quarter turn valve for pipe connection. The valve box shall be equal to model F-12 as manufactured by IPS Corp or approved equal.

21. P-13 Sink with Eyewash:

Elkay ELUHAD211555PD single bowl, 21 in. x 15 in. x 5-1/2 in. deep, under-counter mounted, 18 GA type 304 stainless steel sink with offset rear outlet; coordinate three (4) hole punching for sink with Architectural millwork countertop, sound deadening underside.

Chicago #201A-GN8A-E2805-5CP-369 concealed deck faucet with 8 in. swing gooseneck spout, 2-3/8 inch wrist blade handles, E-2805 0.5 GPM aerator.

Elkay LKAD-35-316 crumb cup strainer with 1-1/2 in. offset tailpiece and type 316 stainless steel ground seat stopper.

1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons. Provide deck mounted eyewash, Guardian Equipment model G1893, 90 degree swivel, all stainless steel construction, corrosion resistant, right hand mounting. Unit shall include ANSI compliant sign. Furnish and install Guardian Equipment G3600LF emergency tempering valve. Valve shall be located below countertop against back wall.

22. P-14: Countertop Sinks (Fab Lab / Maker Space):

Elkay ELUHAD211555PD single bowl, 21 in. x 15 in. x 5-1/2 in. deep, under-counter mounted, 18 GA type 304 stainless steel sink with offset rear outlet; coordinate three (3) hole punching for sink with Architectural millwork and countertop, sound deadening underside.

Chicago No. 786-GN8BV-E7FC-CP-369 concealed deck faucet with 8 in. gooseneck spout, vacuum breaker, 2-3/8 in. wrist blade handles, E7FC 0.74 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper.

1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. x 3/8 in. supplies with stops and escutcheons. Conceal all exposed roughing under sink with Truebro Lav Guard2 #103 E-Z insulation kit. Provide point of use thermostatic mixing valve equal to Chicago Faucet model 131-CABNF.

23. P-15 Kitchenette Sink

Elkay DRKR-ADA-1725, modified #18 ga. type 304 stainless steel, self-rimming, counter mounted sink modified with three (3) hole punching on right ledge, single hole on left ledge, 5-1/2 in. deep, centered rear drain opening, for 3-1/2 in. drain, ADA compliant, overall dimensions 17 in. x 25 in. x 5-1/2 in. deep bowl. Non abrasive sound deadening on underside.

Chicago #201A-GN8A-E2805-369 concealed deck faucet with 8 in. swing gooseneck spout, 2-3/8 inch wrist blade handles, E-2805 0.5 GPM aerator.

Elkay LKAD-35 crumb cup strainer with 1-1/2 in. offset tailpiece and stainless steel ground seat stopper. 1-1/2 in. x 2 in. chrome plated P-trap with cleanout, waste outlet with escutcheon. Pair of 1/2 in. ball valve stops and escutcheons.

Conceal all exposed roughing under sink with Truebro Lav Guard2 #103 E-Z insulation kit.

24. P-16 Gas Turret:

Chicago 980-VR909CAGSAM turret with single ball valve and check. Turret with anti-rotational deck pin, index button indicating gas, satin antimicrobial finish

25. P-17 Master Gas Control Valve:

- 1 Equal to ISIMET – LSP-T – Laboratory Service Panel with “T” handle providing manual operation of solenoid valve. Panel shall have brushed stainless steel door panel and trim with gray powder coated enclosure provided with low voltage transformer and fuse block. Enclosure shall be NEMA 1 rated. Panel shall be labeled “NATURAL GAS SERVICE PANEL”. Panel shall comply with

- UL508-A, Standards for Industrial Control Panels.
- 2 Panel shall have integral printed circuit board with logic device to provide 24-vac output circuit to activate integral 24-vac natural gas solenoid. Activation of output circuit shall be enabled only by switch ON and then keying.
 - 3 The Panel shall be equipped with a service switch and a momentary enabling key switch. Deactivation of output circuit shall not require engagement of enabling key. Panel shall be provided with N/O momentary panic button assembly to deactivate output circuit in case of emergency. Reset after panic shall occur by re-keying. Green LED shall indicate operation ON. Red LED shall indicate that shut-down has occurred due to pressing the panic button.
 - 4 Provide panel with additional terminals for integration of ISIMET Remote Panic Button Assembly and opto-isolated input terminal for integration with facility's alarm system. A fire alarm signal shall deactivate the utility controlled by the LSP Series Panel.
 - 5 Provide panel with dry contact terminals for output integration. ISIMET "Panic" shall provide a notification signal to a secondary alarm monitoring system. Reset of Service Panel shall withdraw notification signal.
 - 6 Service Panel shall be furnished with ISIMET Series 300 normally closed natural gas specific zero differential solenoid. Solenoid coil shall be 24-vac. Solenoid shall be UL listed. Service Panel shall be provided with a ball valve up-stream from solenoid. Thoroughly clean piping system prior to placing into service.
 - 7 Do not install wiring or cable for integrated systems, remote panic assemblies or other interface wiring within conduit for either 24-vac control or 120-vac line voltage. Each wiring system should be housed in independent conduit and not bundled with wiring for other systems. Line and 24-vac control wiring furnished and installed by Electrical Subcontractor.

2.17 BACKFLOW PREVENTERS

A. General

1. Reduced pressure backflow preventers shall lead free construction and shall have bronze inlet strainer, bronze body construction, removable bronze seats, stainless steel internal parts, bronze-bodied ball valve test cocks, non-rising stem gate valves with union or flanged connections between the valves and the device itself, inlet and outlet pressure gauges and comply with requirements of ASSE Standard 1013. Size as indicated on the Drawings. Approved equals may be accepted with proof

of state approval. The backflow preventer shall meet both the NSF 61 and NSF 372 test standards.

2. Furnish one (1) spare parts kits for each size of the device to be installed.
3. Furnish one (1) test kit for use with the reduced pressure devices. The test kit shall be contained in its own carrying case.

B. Acceptable Manufacturers

1. All units shall meet the approval of all Local and State Authorities and be approved by the Department of Environmental Protection.
2. Provide product of Watts, Ames Co., or Febco Regulator.

C. Reduced Pressure Zone Backflow Preventer for the Main Water Service.

1. Reduced pressure backflow preventers shall be lead-free construction and shall be stainless steel construction to provide long term corrosion resistance. The assembly shall consist of pressure differential relief valve located in a zone between two positive seating check valves. The main valve body shall be manufactured from 300 series stainless steel for corrosion resistance. The check valve shall be of thermoplastic construction with stainless steel hinge pins, cam arm, and cam bearing. The check valve shall be modular and shall seal to the main valve body by use of an O-ring. The differential relief valve shall be of stainless steel construction and shall utilize a rolling diaphragm and no sliding seats. The assembly shall include two resilient seated shutoff valves and four-ball type test cock. Gauges shall comply with requirements of ASSE Standard 1013. Size as indicated on the Drawings. Reduced pressure zone valve shall be equal to watts 994 and shall match the pipe size.

D. Reduced Pressure Backflow Preventor (RPBP for boiler makeup, kitchen dishwasher and lab. Supply)

1. ANSI/ASSE 1013, AWWA C506; lead free, bronze body with bronze internal parts and stainless, steel springs; two independently operating, spring-loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate and ball (3/4" – 2" line size) valves, strainer and four test cocks. The RBFP shall be equal to Watts series 909 LF
2. Double Check Backflow Preventer (DBFP for ice machine or as indicated)
3. ANSI/ASSE 1012, AWWA C506; lead free, bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent, assembled with two ball valves, strainer and four testcocks. The DBFP shall be equal to Watts series 007LF.

2.18 UNION AND NIPPLES

- A. All connections between copper tubing and galvanized piping or between copper tubing and all tanks (such as water heaters, chillers, and similar equipment) shall be made with dielectric unions and nipples.
- B. All connection to Water Heaters, Meters, Pumps, and other equipment requiring maintenance or alteration shall be made up with unions. Unions on brass piping, 2 in. and smaller, shall be brass composition "E" in strict accordance with Federal Specification WW-U-516. On plastic piping, use unions of the same material as the piping.
- C. All close and shoulder nipples shall be corresponding materials as the pipe and shall be extra heavy.

2.19 DOMESTIC WATER HEATERS

- A. Furnish and install two natural gas water heaters and one storage tank as detailed on the drawings. The potable domestic water heaters and storage tank shall be by one manufacturer and shall be by Lochinvar, Heat Transfer Products, Laars, or approved equal.
- B. Each water heater shall be a Lochinvar Armor Model AWN401PM having a modulating input rating of 400,000 Btu/Hour each, a recovery capacity of 482 gallons per hour at a 100 deg. F rise and shall be operated on natural gas. The water heater shall be capable of full modulation firing down to 20% of rated input with a turn down ratio of 5:1.
- C. The water heater shall bear the ASME "H" stamp and shall be National Board listed for inputs in excess of 200,000 Btu/Hr. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a five (5) year limited warranty.
- D. The water heater shall be certified and listed by C.S.A. International under the latest edition of the harmonized ANSI Z21.10.3 test standard for the US. The water heater shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The water heaters shall operate at a minimum of 95% thermal efficiency. The water heaters shall be certified for indoor installation.
- E. The water heaters shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The water heaters shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating water heater firing rates for maximum efficiency. The water heaters shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 inches of water column.

- F. The water heaters shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The water heaters shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.
- G. The water heaters shall feature the "Smart System" control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys, password security, pump delay with freeze protection, pump exercise, and USB PC port connection. The water heaters shall feature night setback for the domestic hot water tank and shall be capable of controlling a building recirculation pump while utilizing the night setback schedule for the building recirculation pump. The water heater shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or set-point and enable/disable of the water heater, and a 0-10VDC output of water heater modulation rate. The water heaters shall have a built-in cascading sequencer with modulation logic options of "lead lag" or "efficiency optimized". Both modulation logic options should be capable of rotation while maintaining modulation of up to eight water heaters without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.
- H. The water heaters shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent control of the Domestic Hot Water Pump and Building Re-circulation Pump. All low voltage control wiring between water heater and storage tank shall be provided by Division 22.
- I. The exhaust flues shall be stainless steel sealed vent material, as specified, terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the water heater from the outside. The air inlet shall be stainless steel as specified. The air inlets must terminate using the manufacturers specified air inlet cap. The water heater's total combined air intake length shall not exceed 100 equivalent feet. The water heater's total combined exhaust venting length shall not exceed 100 equivalent feet.
- J. Water heaters shall have direct spark ignition with electronic supervision firing control system.
- K. Furnish and install condensate neutralizing kit with each water heater. Run condensate piping, after neutralized, to the nearest floor drain.
- L. The circulating pump shall be all bronze and operate on a 120 volt, 60 cycle, 1 phase power supply. The pump shall be wired to run with intermittent pump operation.

- M. Furnish and install one vertical water storage tank. Storage tank shall be a Lochinvar Lock-Temp RCA0318 tank having a storage capacity of 318 gallons. The tank shall be constructed with an inner chamber designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a drop in outlet temperature. The storage tank shall be constructed in accordance with ASME requirements. The storage tank shall have a working pressure of 150 psi. The storage tank shall be cement lined and carry a five (5) year limited warranty. The tank shall be constructed with a heavy gauge galvanized steel jacket assembly, primed and pre-painted on both sides. The jacket and tank base shall be a water tight construction with a built-in drain pan, complete with a 3/4" drain connection. The Storage Tank shall be completely encased in high density insulation of sufficient thickness to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The entire assembly shall be mounted on "I" beam skids to facilitate handling and installation.
- N. Expansion Tank: Furnish and install as shown on plans a 35 gallon(12 gallon acceptance volume), 16" diameter x 45" (high) pre-charged steel thermal expansion tank with a fixed FDA approved butyl bladder. The tank shall have a top NPT stainless steel system connection and a .301" - 32 charging valve connection (standard tire valve) to facilitate the on-site charging of the tank to meet system requirements. The tank must be constructed in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code and stamped 150 psi working pressure. Tank shall be Wessels model number TTA-80 or by Amtrol, Taco, or approved equal.

2.20 SELF REGULATING ELECTRIC HEAT TRACE (FOR LHW PIPING)

- A. Acceptable manufacturers:
1. Thermon, Model -HSX
 2. Penair
 3. Raychem
- B. Furnish and install a UL listed system of heaters and components for maintaining the water temperature for the non potable hot water piping.
- C. Manufacturer shall submit catalog cuts showing materials and performance along with detailed shop drawings indicating pipe to be heat traced, splices, power connections and other components for the Engineer's approval.
- D. The self-regulating cable shall consist of two (2) 14 AWG nickel plated copper bus wires embedded in a crosslinked parallel conductive polymer as the heating element.
- E. The heater shall vary its output all along its length to maintain the selected temperature of the system 115° F and operate on 120 volt, single phase power.
- F. The heater shall be tinned copper braid covered by a radiation cross linked polyolefin dielectric jacket.
- G. Power retention of the heating element shall be a minimum of 90% after 1000 hours of exposure in an oven at 185° F while energized or 300 cycles between 50 F and 212° F.

- H. Power connection, end seal, splice and tee components shall be applied in the field.
- I. Manufacturer shall have more than 10 years experience with self-regulating heating cables for temperature maintenance of domestic hot water.
- J. Measure the heater circuit continuity and the insulation resistance between the braid and bus wires with a 2500-Vdc megohmmeter (meggar).
- K. The tests should be performed after the pipe insulation has been installed and prior to installation of wall or ceiling panels and shall be witnessed by the Construction Manager and the manufacturer or the manufacturer's representative.
- L. The heater circuit shall be continuous and meggar readings shall be at least 20 megohms regardless of heater length. Circuits yielding unacceptable readings must be repaired or replaced.
- M. The heater shall be a single cable for all pipe sizes.
- N. Provide circuit breaker with 30 MA ground fault protection.
- O. Electric heat trace system manufacturer shall furnish shop drawings for each system including cable layout, load chart and circuit description.
 - 1. Refer to the manufacturer's hot water temperature maintenance design guide for design details, insulation requirements, maximum circuit lengths and accessory information.

2.21 TEMPERING VALVES

- A. Tempering valves shall be as manufactured by Powers, Symmons, Leonard or equal.
- B. Furnish upon completion of all work, certificates of inspections from the manufacturers stating that authorized factory engineers have inspected and tested the operation of their respective equipment and found same to be in satisfactory operating conditions.
- C. Thermostatic Master mixing valve (TM-1 in Mech. room) : Complete Water Temperature Control station to maintain the return water temperature within the range off 100 degree F to 140 degree F. Valve must compensate for temperature fluctuation due to inlet temperature or pressure changes. Wetted surface of the product must comply lead free requirements and state code. The large and small mixing valve shall be equipped with adjustable high temperature limit stop set, color coded dial, locking temperature regulator, inlet union angle strainer checkstops. All bronze, brass and stainless steel construction. The station shall be preassembled and tested for complete control station and ASSE 1017 listed and shall be capable to interface with building management system.. The station shall include return circulator as specified on schedule, aquastat, automatic balancing valve and bypass line. The temperature control mixing valve shall be equal to Leonard model 4NB-LF with building management controller BMSI.
- D. Thermostatic mixing valve for individual Emergency Showers (TM2). The shower shall ASSE 1071 certified and meet ANSI Z358.1-2009 requirement. The valve shall be equal to Guardian G3700 furnish in stainless steel cabinet and lockable latch. The valve shall be directly linked to control the hot and cold water intake and blend to

deliver tepid water (75F adjustable). The valve shall be capable of supplying 3 to 34 gpm of tepid water at maximum 20 psi pressure drop. In event of restriction or failure of hot water supply, internal bypass shall allow valve to deliver cold water to emergency unit. In bypass mode, valve shall deliver 20 gpm at 30 psi drop. In event of loss of cold water supply, valve shall close and shall not deliver water

- E. Thermostatic mixing valve for individual Emergency Eye Wash (TM2A). The shower shall ASSE 1071 certified and meet ANSI Z358.1-2009 requirement. The valve shall be equal to Guardian G3600LF furnish in stainless steel cabinet and lockable latch. The valve shall be directly linked to control the hot and cold water intake and blend to deliver tepid water (75F adjustable). The valve shall be capable of supplying 2 to 6 gpm of tepid water at maximum 20 psi pressure drop. In event of restriction or failure of hot water supply, internal bypass shall allow valve to deliver cold water to emergency unit. In bypass mode, valve shall deliver 4 gpm at 30 psi drop. In event of loss of cold water supply, valve shall close and shall not deliver water
- F. Point of use mixing valve for single or multi lavatory faucets: Lead free, Thermostatic Mixing Valves with bronze body, Thermostatic wax element design, locking temperature adjustment knob, integral check valves on inlets and ball shut off valve. Minimum flow 0.35 gpm and maximum flow 4.6 gpm. Mixing valve shall be equal to Chicago Faucets 131 ABNF / 131 CABNF or equal.
- G. Furnish and install a 4 in. diameter thermometer on the outlet side of each tempering valve as manufactured by U.S. Gauge Company, Powers Regulator Company, and/or Trerice Company.

2.22 RECIRCULATING HOT WATER PUMPS

- A. General: Hot water circulating pump shall be as manufactured by Bell and Gossett Co., Taco, Thrush or approved equal
- B. Provide where indicated an in-line hot water circulating pump, 1 all bronze with bronze impeller with capacity as shown on the schedule on drawing P001
- C. The recirculation pump (RP-1) shall be enable and disable by the BMS on a set time schedule method. Once pump is enable, the control of the pump shall by means of immersion aquastats with visible scales and detachable wells which shall be installed in the recirculation lines and shall be so designed and connected that when the water temperature in the 140 degree F recirculating line drops to 115 degrees F, the pump shall start and when the temperature reaches 135 degrees F, the motor shall stop and when the water temperature in the 105 degree F recirculating line drops to 90 degrees F, the pump shall start and when the temperature reaches 100 degrees F, the motor shall stop.

2.23 TRAP PRIMERS

- A. The trap primer shall be as manufactured by Precision Plumbing Products, Inc., Jay R. Smith, MIFAB or approved equal.
- B. Furnish and install trap primer units to serve one or two drains. Provide trap primers to all floor drains as required by 248 CMR Plumbing code.
- C. For one or two floor drains, the trap shall be Precision Plumbing Products, Inc. Model MP-500, 1/2" connections, Electronic automatic brass trap primer units which shall be by timer to active cold water line in which attached. Units shall meet Code and ASSE Standard #1018. Units shall be adjustable to line pressure and desired delivery amount. Units shall deliver a maximum of two ounces of water on a 15 second pressure drop and have corrosion resistant brass fittings with a copper reservoir with clear plastic inspection cover, and mounting brackets, "O" ring seals.
- D. Electronic Trap Primer (ETP) for multiple floor drain, the trap primer unit shall be equal to Precision Plumbing Products Model PTS. The electronic Time Trap priming manifold (ETP) shall supply 2 oz water at 20 psi at a preset 10 second every 24 hours. The manifold steel cabinet shall include , vacuum breaker, pre-set 24 hour time clock, manual override switch, 120V solenoid valve, 3 wire connection, NPS 3/4" inlet connection, manifold, compression outlet fittings, inlet shut off valve
- E. Install units one foot above the flood level of the device served for every 20 feet of primer line. Pipe according to manufacturer's instructions, off top of supply line, and 15-1/4" down to bottom of distribution units.
- F. Units serving multiple devices shall be furnished with #SS-8 straight supply tube and #DV-2 distribution unit.
- G. Plumbing Subcontractor shall adjust all units and cycle all primers at least six times to insure proper activity.

2.24 WATER HEATER AIR INTAKE AND FLUE

- A. The air intake and exhaust vents shall be double-wall stainless steel, factory-built type for use on condensing appliances.
- B. Maximum temperature shall not exceed 550°F.
- C. Vent shall be listed for an internal static pressure of 6 in. w.g. and tested to 15 in. w.g.
- D. Vent shall be constructed with an inner and outer wall, with a 1 in. annular insulating air space.
 - 1. The inner wall (vent) shall be constructed of AL29-4C superferritic stainless steel, .015 thickness for 4 in.-12 in. diameters.
 - 2. The outer wall (casing) shall be constructed of type 430 stainless steel, .018 thickness for 4 in.-12 in. diameters..

3. Inner and outer walls shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.
- E. All parts exposed to the weather shall be stainless steel.
 - F. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be included.
 - G. Roof penetration pieces shall be UL listed and provided by the vent manufacturer.
 - H. All inner vent connections shall be secured by means of profiled connector bands with gear clamp tighteners. Joints shall be sealed with waterproof sealant. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
 - I. Vent shall terminate in accordance with installation instructions and local codes.
 - J. Manufacturers: Subject to compliance with requirements, provide all steel, insulated, positive pressure double wall vents of one of the following:
 1. Metal-Fab, Corr/Guard Model CG
 2. Selkirk Heat-Fab Saf-T Vent CI
 3. Schebler eVENTplus
 4. or equal

2.25 CONDENSATE NEUTRALIZING TUBES

- A. Contractor shall furnish and install condensate neutralizing tubes for new boilers and domestic water heater condensate drains and flue pipe condensate drains.
- B. Neutralizer tubes shall be as manufactured by JJM Boiler Works, Neutra-Safe, Fireside Condensate Neutralizers, or approved equal, and sized according to input rating of each piece of equipment.
- C. The boiler/water heater and flue condensate drains shall not be combined, Provide separate neutralizing tubes for boiler/water heater and flue condensates. All piping shall be per manufacturer's piping diagrams and directions. Secure neutralizing tubes to the floor.

2.26 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete barrel sections and transition top sections shall conform to ASTM C478 and meet the following requirements:
- B. Manholes shall have a minimum 48 inch interior diameter with a wall thickness of not less than 5 inch.
- C. Top sections shall be eccentric except that barrel sections shall be used where shallow pipe cover requires a top section less than 4 feet.

- D. Barrel sections shall have tongue and groove joints. Manholes shall be manufactured in the configuration shown on the Drawings with the bell of the manhole section pointing down.
- E. All sections shall be cured by an approved method and shall not be shipped or subjected to loading until the concrete compressive strength has attained 3,000 psi and not before five days after fabrication or repair, whichever is longer.
- F. Precast concrete barrel sections with top slabs and precast concrete transition sections shall be designed for a minimum of HS-20 loading plus the weight of the soil above at 120 pcf.
- G. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section.
- H. Precast concrete bases shall be constructed of and installed as shown on the Drawings. The thickness of the bottom slab of precast bases shall not be less than the manhole barrel sections or top slab, whichever is greater.

2.27 MAIN HOUSE WATER METER

- A. The main house water meter shall be in accordance with the requirements of the local water department. Water meter shall be lead free, compound type, conforming to AWWA Standards. Size meter and arrange piping and specialties to comply with utility company requirements.
- B. The meter shall be the remote reading type with the radio remote read device mounted in an acceptable location.
- C. Shut-off valves shall be installed on both sides of the meter and a strainer shall be installed on the inlet side of the meter after the inlet shut-off valve. Provide bypass per local requirements.

2.28 WATER SUB METERS (SM1 to SM3)

- A. Water sub meter shall record water supply and shall be provided as shown on the drawing. Refer to drawing P0.01 for sub meter application diagram.
- B. Provide water meter for flow measurement of potable water supply to the school facility and shall be capable to integrate with building control management system. Provide BACnet MS/TP control interface module for communication with BMS system. The water meter shall be a non-intrusive kind that requires no cutting of pipe or drilling of a hole. The device shall not be in contact with the water and thus it shall not cause pressure drop.
- C. Design of the water meter shall use transit-time ultrasonic technology along with transducers to provide for flow totalizing (gallons used) and flow rate (gpm) in real time. Water meter (s) shall be wall-mounted and capable for +1% accurate flow measurement of clean liquids, suitable for liquids that contain small amounts of suspended solids or particle in sizes smaller than 100 um in order to make a measurement. The meter shall be able to operate in temperatures ranging from 32°F to 212°F and come equipped with a device that emits pulse signals.

- D. The clamp-on sub-meter shall contain a display that is LCD with backlight. Indication for flow rate and flow accumulator shall be displayed in English (US) units.
- E. Clamp-on transducers that are strapped to the water lines and wired directly to the sub-meter electronics enclosure must be provided as part of the potable water sub-metering system.
- F. The input/output interfaces and RD485 port to integrate with building management system.
- G. Enclosure shall be weather-resistant, NEMA 4X or IP65. It shall be constructed of stainless steel
- H. Acceptable Manufacturers and Models are EF10-WA-DC12 by Spire Metering, STUF-300FxB by SHENITECH, TFX by Dynasonics; or equal
- I. Shut-off valves shall be installed on both sides of the meter. Provide bypass with shut off valve around water sub meter.

2.29 GAS SUB-METER

- A. The Plumbing Subcontractor shall furnish and install gas sub-meter(s), which are to be integrated with the building management system (BMS). Interfacing gas sub-meters with the BMS shall allow for recording data on gas consumption, registering gas load trending and monitoring of gas pressure delivered to gas-burning equipment.
- B. Gas meter shall be provided to monitor the facility total gas consumption.
- C. Gas sub-meter(s) shall provide accurate mass flow measurement utilizing pipe insertion type flow measuring probe and readout display. The meter shall provide low pressure drop across the sub-meter and shall be designed with high rangeability at 40:1 and 1% accuracy. Sub-meter(s) shall contain inherent feature that provides for temperature compensation.
- D. The meter shall be capable of providing 4-20mA output and pulse output and shall be capable of transmitting signal outputs to the energy management system.
- E. The meter shall be UL tested and approved by the Massachusetts plumbing board.
- F. Acceptable manufacturers are Onicon F-5300, Fox Thermal Instruments, EPI flow or equal.

2.30 GAS PRESSURE TRANSMITTER

- A. This device is to be furnished, installed and wired by the temperature control contractor. Plumbing Subcontractor shall provide a fitting for insertion of the gas pressure sensor into the supply header piping to gas-fired equipment and sensor well in piping.

2.31 ELEVATOR SUMP PUMPS

- A. The contractor shall furnish and install an elevator sump complete with oil detection control system for each elevator pit, as shown on the drawings. The system shall be capable of pumping water while containing oil. The pump and oil sensor technology control system shall comply with ASME 17.1 standards. The system shall function automatically without human intervention. In addition, the system shall provide separate alarms in the event of an oil spill, high liquid level condition, or overcurrent condition due to a pump fault. All controls shall be UL 508a approved. All components of system shall be UL approved. Pump shall be approved to UL 778 and/or CSA C22.2. The product shall be equal to Bell & Gossett, Stancor oil minder or Liberty Pump.
- B. The sump pump shall be designed to handle without clogging clean water, contaminated water, wastewater effluent, storm water, and other similar liquids that may contain small solids. The pump shall have integrated feet allowing it to stand on a hard bottom wet well. Major pump components shall be made from Stainless Steel 304 and FC-20 Cast Iron, with smooth surfaces devoid of porosity or other irregularities.
- C. The motor housing shall be 304 stainless steel and the top cover of Nylon 66. The motor shall be of the squirrel-cage induction design with copper windings, housed in an air filled, water tight chamber. The motor shall be capable of continuous submerged operation under water to a depth of 30 feet. The stator windings and stator leads shall be insulated with moisture resistant Class E insulation rated for 120oC (248o F). The motor shall be capable of operating continuously, submerged in liquid of 40oC (104o F) without overheating.
- D. The control panel shall include a field adjustable switch with variable sensitivity settings for oil with a separate over-current relay and field adjustable motor overload heater with an optional automatic or manual reset button. The control panel shall have an adjustable high decibel warning horn with illuminated red light and alarm silencing switch. The Oil Minder Main control shall be factory wired (pump, oil probe and floats) within the NEMA 4X enclosure. Separate LED indicator lights allow users to monitor: 1) oil alert, 2) high water, 3) high motor amps, 4) power to system 5) pump activation and 6) Dry contact for remote notification to BMS.

2.32 ACID NEUTRALIZATION SYSTEM

- A. Furnish and install complete acid neutralization and PH monitoring systems including all piping, equipment, and interconnection power and control wiring from power panel to all components. Power to panel is furnished under the Electrical Division 26 of the Specifications. Plumbing Subcontractor is responsible to furnish and install using properly licensed personnel all conduit and wiring between the panels and monitoring points. All materials and methods used for this wiring shall be consistent with the requirements of Division 26.
- B. The Acid Neutralization tank (ANT) shall be constructed of virgin high density polyethylene conforming to ASTM , D1248 for polyolefin materials. Tank shall be equal to Orion Tank 360g, exterior lining to consist of 1/8" reinforced fiberglass (FRP). Refer to drawing for tank size and capacity. Tank shall be self-supporting and rated for continuous operation temperature of 160 degrees F, and intermittent operation at 200 degrees F. Tank shall be provided with gasketed and bolted manhole with stainless

steel nuts and bolts. Inlet/outlet/vent pipe fittings shall be made of polyethylene and fusion welded to tank. Tank shall be charged with limestone in accordance with manufacturer's recommendation prior to putting in service. Chips or lumps shall be more than 90 percent calcium-carbonate content and 1- to 3-inch diameter.

- C. System shall be as manufactured by Burt Process Equipment and consist of the following:
1. Acid neutralizing tanks shall be polyethylene type with fitted with inlet, outlet, and vent connections as detailed on Drawings. Tanks shall be installed as shown on the drawings. Include full charge of limestone chips and a second charge of chips.
 2. PH sensors shall be compatible with controller, encapsulated electrodes with automatic temperature compensation, measuring range of 0-14 PH sensitivity, and have 2 conductor shield cable.
 3. PH receivers to accept 4-20 MA signal, with both digital and simulated analog display capabilities.
 4. The recorders shall be strip chart type, single pen with a 2-5/16" chart width. The chart shall record for a minimum of 30 days. The unit shall operate on a 0-1 MA signal with a power requirement of 115v AC 60 Hz.
 5. Receivers and recorders shall be housed in a NEMA IV styrene enclosure with single weatherproof door.
 6. Control panels shall be completely pre-wired and pre-tested, NEMA IV type enclosure, wall mounted, hinged and locked front panel with components as follows:
 - a. Receiver/Analyzer
 - b. Strip Chart Recorder
 - c. PH Out of Spec Hi/Lo Alarms
 - d. System On/Off Switch
 - e. Alarm Test and Silence Buttons
 7. U-Trap Assembly shall be heat fusion jointed polypropylene pipe and fittings with an extension section to house the effluent PH probe.
 8. All components and instrumentation for the neutralization systems shall be furnished for installation from a single source and shall be installed in strict accordance with the manufacturer's recommendations.
 9. System calibration and start-up shall be included in the package provided by the manufacturer. The manufacturer shall also be responsible for conducting a training seminar for the site facilities people prior to the system being turned over to the Owner (minimum 4 hours).
 10. The manufacturer, as part of his package, shall be responsible for making not less than three visits during the first year of operation to check up on the workability of the system.

2.33 GREASE TRAPS

- A. General

1. Grease trap shall be as manufactured by Rockford Separators, Jay R. Smith, MIFAB, Zurn or approved equal.
2. GI-1 & 2 : Furnish and install fully recessed grease Interceptor and shall be equal to Jay R. Smith 8450 integral with extension, 75 GPM flow rate, 150 lbs capacity, 4" inlet & outlet, Steel interceptor with integral extension with gray Duco coating inside and outside and Flow control fitting. The grease trap shall bear the seal of approval from the Plumbing Drainage Institute and Mass approved product.

2.34 SOLID (PLASTER) INTERCEPTOR

- A. MIFAB Model Z-1180, Jay R Smith Josam or approved equal large capacity steel interceptor with acid resistant coating, diffusing screens, sediment bucket and gasket screw down cover. The interceptor shall be installed at each art room sink. Interceptor at barrier free fixtures shall be installed in adjacent casework to maintain accessibility clearance.

2.35 PRECAST CONCRETE GREASE TRAP (OUTDOOR INTERCEPTOR)

- A. Precast concrete grease trap:
 1. Grease trap shall have 5,000 gallon capacity with an exterior dimension as shown on the drawing. Grease trap shall include 6 in. cast iron inlet and outlet tees.
 2. Precast concrete grease trap shall be designed for AASHTO HS-20 loading and have steel reinforcement in accordance with ASTM A-615-75 Grade 60, 1" Minimum Cover.
 3. Tank shall have a concrete minimum strength of 5,000 P.S.I. @ 28 days.
 4. Grease trap shall be constructed with tongue and groove joints between sections. Joints between sections shall be sealed with preformed rubber gaskets conforming to ASTM C 443.
 5. Exterior surfaces of grease trap shall receive a heavy shop-applied coating of bituminous waterproofing
 6. Each section of the grease trap shall have no more than 2 suitable lifting holes or cast-in lifting devices.
 7. Precast grease trap shall be manufactured with wall openings to receive the ends of pipes which are to be connected to structure. Pipe openings in base shall be minimum size required to receive pipe, and shall be accurately set to conform to the required line and grade.
- B. Precast concrete grease trap shall be similar to those be manufactured by:
 1. Old Castle Precast, Rehoboth, MA
 2. Scituate Ray Precast, Scituate, MA
 3. E.F. Shea New England Concrete Products. Wilmington, MA

2.36 KITCHEN CO AND GAS CONTROL VALVE

- A. Provide Kitchen CO controller, gas valve and CO sensor near kitchen gas appliances. The control panel shall be equal to ASCO 108D90C. Other equal

manufacturers are ISIMET- Model LA-2215-R-P-C, Honeywell or Equal.

1. Panel shall be brushed stainless steel with concealed wall box provided with panel service switch, low voltage transformer and fuse block. Panel shall comply with UL508-A, Standards for Industrial Control Panels. Panel should include a clear flip up protective cover for panic button. The mounting height for the control panel shall be 60" from the finished floor.
2. Panel shall have integral printed circuit board with logic device to provide a 120-vac output circuit to activate the Fuel Gas Solenoid and a 24-vac output circuit to activate utilities as shown on drawings. Activation of output circuits shall be enabled only by switch ON and then keying.
3. The Panel shall be equipped with a service switch for the output circuits and a momentary enabling key switch. Deactivation of output circuits shall not require engagement of enabling key. Panel shall be provided with N/O momentary panic button assembly to deactivate output circuits in case of emergency. Reset after panic shall occur by re-keying.
4. Provide panel with CO Sensor and opto-isolated input terminal for integration with facility's alarm system. A fire alarm signal shall deactivate all utilities controlled by the Control Panel.
5. Provide panel with dry contact terminal and 24-vac terminal for output integration. "Panic" shall provide a notification signal to a secondary monitoring system. Reset of Controller shall withdraw notification signal.

B. Carbon Monoxide (CO) Sensor:

1. Carbon Monoxide Sensor shall be Honeywell model E3SA sensor with E3SCO cartridge. Locate as shown on Drawings and integrate assembly with Kitchen Hood Controller. Protech and Dwyer are other approved manufacturer.
2. Remote Carbon Monoxide Sensor shall be Honeywell model E3SRMCO. Locate as shown on Drawings and integrate assembly with Kitchen Hood Controller.
3. Mounting Note: CO Sensor should be wall mounted at a height of five feet above the floor and at least ten feet away from fuel gas burning equipment. This will allow a visual notification of detection and will prevent false positive readings from the sensor.

C. Solenoid Valve:

1. Furnish and install ASCO EF8215 normally closed natural gas specific zero pressure differential solenoid. ISIMET Series 300 and Honeywell are other approved manufacturers.
2. Solenoid coil shall be 120-vac. Provide a ball valve up-stream from solenoid. Thoroughly flush piping system prior to placing into service. Final connection to coil from control unit by Electrical Contractor. Solenoid shall close upon loss of operating power and require re-keying for reactivation of service.

2.37 FIRESTOP SYSTEMS

- A. General: Provide firestopping at all new fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 07 84 00 - Firestopping, for all product requirements for maintaining integrity of fire-rated construction at penetrations.

2.38 ACCESS PANELS

- A. Furnish access doors and frames for walls and ceilings to General Trades Subcontractor for installation. Size as required for access and maintenance, minimum 18 by 18 inches. Refer to specification section 08 31 00 ACCESS DOORS AND FRAME

2.39 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in Section 01 50 00 - Temporary Facilities and Controls and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of Section 01 50 00 - Temporary Facilities and Controls shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contract requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the General Contractor pursuant to MGL (Refer to Section 01 50 00 - Temporary Facilities and Controls and as additionally required for dust control).
 - 3. General Contractor is responsible to provide enclosures required for temporary heat; refer to Section 01 50 00 - Temporary Facilities and Controls.
 - a. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility of this Trade Contractor.

2.40 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - Temporary Facilities and Controls.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND INSTALLATION METHODS

- A. All work shall be installed in a first-class manner consistent with the best current practices. All materials shall be securely installed plumb and/or level, and all flush mounted equipment shall have front edge flush with finished wall surface.
- B. All piping shall be installed true to line and grade in the case of underground piping. All piping above ceilings or exposed shall be grouped together, be parallel to each other, and be either parallel or perpendicular to the structure. Utilize gang hangers wherever feasible. Group all valves together where feasible.
- C. Training:
 - 1. Train the Owner's maintenance personnel on troubleshooting procedures, and servicing and preventative maintenance schedules and procedures.

2. Schedule training with Owner through the Architect with at least 7 days prior notice.

3.2 WORK COORDINATION AND JOB OPERATIONS

- A. The equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same.
- B. Particular attention shall be directed to the coordination of piping and other equipment installed in the ceiling areas. Coordinate the elevations of all piping in hung ceiling areas to insure adequate space for the installation of recessed lighting fixtures before other mechanical equipment is installed.
- C. Furnish to the General Contractor, and all other Subcontractors, all information relative to the portion of the Plumbing installation that will affect them, sufficiently in advance so that they may plan their work and installation accordingly.
- D. In case of failure to give proper information as indicated above sufficiently in advance, pay for all back-charges for the modification, renovation, and relocation of any portion of the work already performed.
- E. Obtain from the other trades, all information relative to the Plumbing Work to be executed in conjunction with the installation of their respective equipment.

3.2 CUTTING AND CORE DRILLING

- A. Perform all cutting and core drilling operations that are outlined in Part 1 of this SECTION. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting, verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved Coordination Drawings
- B. Cut all masonry and concrete with an approved diamond blade concrete saw in a neat straight direction, perpendicular to the plane of the wall or floor.
- C. Use a core drilling process which produces clean, sharp edges and the minimum hole size which will accommodate the size of pipe sleeve specified. Submit procedures for cutting thru existing steel beams to Architect for review.
- D. The patching of holes shall be performed by Plumbing Sub-contractor utilizing methods outlined for the finish trade involved. Holes shall be patched to the satisfaction of the Architect.

3.3 CLEANING AND PROTECTION

- A. Protect all materials and equipment during shipment and so as to prevent damage. Water closets, lavatories, and sinks shall be boarded over and all other fixtures shall be protected with pasted on paper. Post notice prohibiting the use of the fixtures prior to completion. Assume full responsibility for protection of work until its completion and final acceptance.

- B. Keep the premises reasonably clean at all times and remove rubbish caused by the Plumbing Work as directed by the Architect.
- C. Upon completion of this work, clean all fixtures and equipment installed herein and replace damaged parts. Failure to fulfill this obligation will result in back-charges for correction of the defective work.

3.4 SLEEVES, INSERTS, AND ESCUTCHEONS

- A. All piping passing through slabs, floors, walls, partitions, foundation walls and grade beams, shall be sleeved and all such sleeves shall be furnished and installed by the Plumbing Subcontractor as detailed on the Drawings and herein specified. Set sleeves in concrete floors and walls as soon as forms are set and before concrete is poured. Core drilling openings shall have a sleeve caulked and grouted in place.
- B. All pipes passing through floor, whether slab-on grade or above grade levels, shall be sleeved with sleeve extending 1 in. above floor. This includes all piping in toilet room pipe space, stairwells, closets, partitions and pre-cast planks.
- C. All sleeves shall be Schedule 40 galvanized steel and shall be reamed. Sleeves on insulated pipe shall be large enough to allow insulation to pass through sleeve. Sleeves on drywall, masonry, or concrete walls and partitions, shall be flush with wall on both sides.
- D. The space between sleeve and pipe in all cases shall be filled with a U.L./F.M. approved caulking compound. This includes pipes concealed in chases and/or partitions.
- E. Inserts where required shall be furnished and set by the Plumbing Subcontractor and where necessary may be drilled or power driven and shall be sized such that the insert will not exceed a depth of penetration of 1 in. into concrete.
- F. Escutcheons: All exposed pipe, uncovered, passing through walls or floors or ceilings shall be fitted with C.P. brass spun or split type escutcheons with approved clamping device for holding in position. Floor escutcheons shall be deep enough to fit over sleeves, fastened to pipe, and extend down to floor.

3.5 TESTING

- A. Test all Work in the presence of the Architect and/or Engineer and as required by Local Codes.
- B. After Soil, Storm, Special Waste, and Vent Piping is in place and before being buried or furred in, plug lower ends and fill the system with water up to the top of stacks. Piping is to be left tight under these conditions and water level shall be maintained intact for the period of at least four (4) hours.
- C. Test all water piping by applying a hydrostatic pressure of 150 PSIG using a pump for this purpose. Make sure that all lines are properly plugged or capped and that air has been vented before applying pressure which shall remain constant without pumping for two (2) hours at least.

- D. Test gas piping per State Gas Code.
- E. Any leaks in joints or evidence of defective pipe on fittings disclosed by test shall be immediately corrected by replacing defective parts with new joints or materials. No makeshift repair effected by caulking threaded pipe with lead wool, application or Wilky or patented compounds will be permitted.
- F. Manhole Exfiltration Test:
 - 1. Plug pipes in manhole; remove water in manhole; observe plugs over period of not less than 2 hours to ensure there is no leakage into manhole.
 - 2. Fill manhole with water to within 4 inches of top of cover frame. Prior to test, allow manhole to soak from minimum of 4 hours to maximum of 72 hours; after soak period, adjust water level inside manhole to within 4 inches of top of cover frame.
 - 3. Measure water level from top of manhole frame; at end of 4 hour test period, again measure water level from top of manhole frame; there shall be no drop in water level during test period.
 - 4. When unsatisfactory test results are achieved, repair manhole and retest until result meets criteria; repair visible leaks regardless of quantity of leakage.
- G. Provide testing report for all systems tested.

3.6 CHLORINATION

- A. Upon completion of the Plumbing Work, thoroughly chlorinate the entire domestic water system before putting same in service. Chlorinate all work in the presence of the Architect and/or Engineer. The chlorinating agent shall be as a solution of sodium hypochlorite. Water shall be fed slowly into the new line with chlorine in the proper amount to produce a dosage of 50 PPM. Open and close all valves while system is being chlorinated.
- B. After the sterilization agent has been applied for 24 hours, pay for an independent testing agency to test for residual chlorine and for presence of bacteria. A residual of not more than 5 PPM shall be required in all parts of the line.
- C. If test show 5 PPM or greater of residual chlorine, flush out system until all traces of the chemical used are removed.
- D. Provide testing report from independent testing agency.

3.7 INSTALLATION OF FIRESTOP SYSTEMS

- A. General: Install firestop systems at all fire-rated construction where penetrated by the Work of this Section.
- B. Refer to Section 07 84 00 - Firestopping, for all installation requirements for maintaining integrity of fire-rated construction at penetrations.

3.8 CROSS CONNECTION PROTECTION AND APPROVALS

- A. Protect potable water piping outlets and connections to equipment or machinery against backflow with an air-gap or approved backflow preventer.
- B. Backflow preventer type, application, and installation shall comply with the Commonwealth of Massachusetts, Department of Environmental Protection (DEP) Drinking Water Regulations 310 CMR 22.00.
- C. Mount backflow prevents horizontal at heights and with clearances as required by DEP regulations.
 - 1. Reduced pressure backflow preventers shall be installed between 36 inches to 48 inches above the floor with a minimum of 12 inches clear space from back wall and 3'0" in front.
 - 2. Provide indirect waste piping with funnel to receive discharge from reduced pressure backflow preventer atmospheric vents and spill through air gap into floor drain.

3.9 SYSTEM INSTALLATION

- A. Sanitary Waste and Storm Drainage System
 - 1. The Plumbing subcontractor shall be responsible for checking each pipe for alignment, center line elevation and invert grade for underground installations.
 - 2. At times when work is not in progress, open ends of pipe and fittings shall be securely closed to the satisfaction of the Project Manager so that no trench water, earth or other substance will enter the pipe or fittings. Any section of a building drainage system that is found defective in material, alignment, grade or joints before acceptance shall be corrected to the satisfaction of Project Manager. Pipe laid through rock excavation shall rest on a six inch layer of well compacted sand.
 - 3. The sanitary (soil, waste and vent), storm drainage piping three inches and smaller in diameter shall pitch a minimum of 1/4 inch per foot. Piping four inches and larger in diameter shall pitch a minimum of 1/8 inch per foot.
 - 4. The soil, waste and vent stacks shall be connected as shown and extended through the roof a minimum of 18 inches. Soil, waste and vent pipes shall be concealed unless otherwise noted.
 - 5. Branch connections to each drainage system shall be made with "Wye" and long turn "Tee Wye" fittings. Installation of short radius 1/4 bends, common off sets, double hub fittings and saddles will not be approved. Installation of short "Tee Wye" fittings will be permitted for vertical piping only, and only where space conditions will not permit the use of long turn fittings. Only fittings conforming to the Code shall be installed.
 - 6. The changes in direction of each drainage system shall be made with "Wye" branches and 1/8 bends. Provide long sweep bends at bottom of stacks with a vertical cleanout just above the floor at places where a "Wye" and 1/8 bends and end cleanouts cannot be installed.
 - 7. Every fixture shall be separately trapped and the traps must be vented unless an approved battery vented system is being installed. Floor drains shall be considered as a fixture.

8. Vents shall be connected to the discharge of each trap in the sanitary system, thence carried individually to a point above the flood level of the fixture before connecting with any other vent pipes. Pitch the branch vents back to the fixture.
9. Collect individual vent pipes together in branch vent lines and connect to vent stacks. Wherever possible, vent stack offsets shall be made with 45 degree fittings. The vents passing through the roof shall be a minimum size of four inches in diameter.
10. Cleanouts shall be provided in drainage piping at changes in directions, at foot of stacks or other required points accessible for cleaning or rodding out.
11. Cleanouts shall be of the same size as the pipe installed in up to four inches in diameter and not less than four inches in diameter for piping larger than four inches in diameter.
12. The maximum horizontal distance between cleanouts in piping four inches in diameter and smaller shall not be more than 50 feet apart. In piping five inches in diameter and larger, cleanouts shall not be more than 100 feet apart.
13. Traps on sanitary piping not integral with fixtures and in accessible locations shall be provided with a brass trap screw protected by the water seal, and will be regarded as a cleanout.
14. Test tees with brass cleanout plugs shall be provided at the foot of all vertical soil, waste and storm drainage stacks and at each floor. Wherever cleanouts on vertical lines occur concealed behind finished walls, they shall be extended to back of finished wall, and a wall plate shall be provided.

B. Cold and Hot Water Piping

1. Vacuum breakers shall be installed on supplies to each piece of equipment to prevent back siphonage.
2. Branch lines from water service or main lines shall be taken off the top or bottom of main, using such crossover fittings as may be required by structural or installation conditions. All water service pipes, fittings, and valves shall be kept a sufficient distance from other work to permit finished covering to be not less than 1.5 inches from other work and not less than 1.5 inches between coverings on the different services.
3. Provide shock absorbers at special equipment, tops of the risers, at each individual or each group of fixtures.
4. Water piping shall be run parallel and graded evenly to the drainage points. There shall be a 2 inch drain valve provided for each low point in the piping so that all parts of each water system can be drawn off.
5. Provide suitable means of thermal expansion for the hot water piping using swing joints, expansion loops and long turn offsets as required to suit building conditions.
6. Piping connections to equipment shall be provided with unions or flanges to permit convenient disassembly for alterations and repairs.
7. No piping shall be installed in a manner to permit back siphonage or any flow of water from sanitary or drainage systems into the water systems or their distribution piping under any conditions.
8. Air gaps, open end of funnel drains, and approved vacuum breaking devices shall be provided as specified or as indicated on the Drawings. Piping to hose

- end faucets or hose end fittings, or any fixtures where water supply outlet is below the fixture overflow rim shall have vacuum breakers.
9. Where flanges are installed in the water systems, red rubber gaskets shall be installed between each pair of flanges.
 10. Heating or bending of copper tubing to eliminate the installation of fittings will not be permitted.
 11. Piping systems shall be kept clean during all phases of work. Open ends of incomplete piping shall be protected to prevent the entrance of foreign materials.
 12. Pipe shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.
 13. Provide copper plated friction clamps on the old water supplies to each water closet and urinal flushometer. Friction clamp shall be firmly clamped to the pipe and shall be firmly attached to the adjacent wall structure.

C. Installation of Natural Gas Piping

1. General: Install natural gas piping as shown on the drawings in accordance with the State of Massachusetts Uniform Plumbing/Gas Code as follows:
 - a. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.
 - b. Unless otherwise indicated, gas piping shall be run exposed. Where concealed piping is indicated, it shall be installed in a location to permit access to the piping with a minimum amount of damage to the building.
 - c. The connection to the gas main in the street, piping and valves outside the building and meter installation shall be in accordance with local gas utility requirements.
 - d. The gas supply pipe shall be of the size indicated on the drawings.
 - e. A stop cock or tee handled ball valve, with cast iron extension box and cover, shall be installed in the gas supply pipe near the curb. A brass gas cock shall be installed in the gas supply pipe just inside the building wall. If the gas supply pipe is larger than 2 inch size, a bronze mounted iron body gate valve may be provided in lieu of the brass cock.
 - f. Joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed and all burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.
 - g. An approved type gas cock shall be installed in the branch connection to each riser and near each appliance. Plugged or capped outlets for future extensions or connections shall be provided where noted on drawings. Piping shall be graded not less than 1 inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter

shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.

- i. A full size tee fitting and a 6 inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.
 - j. Uncovered, exposed pipes shall be provided with plates at the point where they pass through floors, finished walls, and finished ceilings. Where necessary to cover beads of fittings, special deep escutcheons shall be provided in lieu of plates. Plates shall be not less than 0.018 inch thick. Wall and ceiling plates shall be secured with round head set screws, not with spring clips. Unless otherwise specified, plates shall be of the one piece types. Wall and ceiling plates may be flat, hinged pattern.
 - k. Exterior gas piping shall have a cover of 30 inches and shall be a minimum of 3 feet from other structures such as other site piping.
 - l. Connections between metallic and plastic piping shall be made only underground, exterior and with an approved transition fitting.
 - m. Special care shall be taken and additional supported provided with installing the exposed exterior gas piping located at the emergency generator.
2. Installation of Valves
- a. Gas Valves: Provide and install gas valves at connection to gas train for each gas fired equipment item; and on risers and branches where indicated on the drawings. Locate gas valves where easily accessible and where they will be protected from possible injury.
 - b. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility companies requirements and manufacturer's installation instructions. Install gas shutoff valve upstream of each pressure regulating valve.
3. Equipment Connections
- a. General: Connect gas piping to each gas fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.
4. Testing
- a. General: Inspect, test, and purge natural gas systems in accordance local code requirements and NFPA 54 requirements and as follows.
- D. Pressure test natural gas system with dry air or nitrogen at 100 psig for 2 hours. Soap test all joints to detect leaks.
- E. Flush and purge natural gas system and charge with gas in accordance with local utility requirements and NFPA 54.

3.10 GENERAL INSTTALATION REQUIREMENTS

A. Piping Installation

- 1. Install piping approximately as shown on the drawings and as directed during installation by the Designer's representative.
- 2. Piping shall be installed as straight and direct as possible, forming right angles or parallel lines with building walls, other piping and be neatly spaced.

3. The horizontal runs of piping, except where concealed in partitions, shall be installed as high as possible.
4. Piping or other apparatus shall not be installed in such a manner as to interfere with the full swing of the doors and access to other equipment.
5. The arrangement, positions and connections of pipes, fixtures, drains, valves, and the like, indicated on the Drawings shall be followed as closely as possible.
6. It shall be possible to drain the water from all sections of each cold and hot water piping system. Pitch piping back to drain valves.
7. Screwed piping of brass or chrome plated brass shall be made up with special care to avoid marring or damaging pipe and fitting exterior and interior surfaces.
8. Small fittings shall be taper thread. Lampwick, cord, wool or any other similar material shall not be used to make up thread joints.
9. Screwed pipe and copper tubing shall be reamed smooth before installation.
10. All exposed piping in connection with fixtures shall be chrome plated. Where chrome plated piping is installed, cut and thread pipe so that no unplated pipe threads are visible when work is completed.
11. Reducing fittings, unless otherwise approved in special cases, shall be provided in making reduction in size of pipe. Bushings will not be allowed unless specifically approved.
12. Remove and replace with new materials, any copper or brass piping (chrome plated or unplated) showing visible tool marks.
13. Vertical risers shall be firmly supported by riser clamps, properly installed to relieve all weight from the fittings.
14. Any piece of pipe six inches or less in length shall be considered as a nipple.
15. All water service piping shall be kept a sufficient distance from other work to permit finished covering to be not less than 1.5 inches from other work and not less than 1.5 inches between the coverings (insulation) on the different services.
16. Underground piping, welding and welded joints shall conform to welding procedure detailed in AWWA Standard C206 for field welding water pipe.

B. Hanger Installation

1. All piping shall be supported from the building structure by means of approved hangers and supports, to maintain proper grading and pitching of lines, to prevent vibration and to secure piping in place, and shall be so arranged as to provide for expansion and contraction.
 - a. Maximum spacing of hangers on soil pipe shall be five feet and hangers shall be provided at all changes in direction. Vertical hanger rods to support piping from the structure or supplementary steel shall not exceed four feet in total length. Where pipe support assemblies exceed four feet in total length vertically, Plumbing subcontractor shall provide factory fabricated channels and all associated accessories.
 - b. Friction clamps shall be installed at the base of the plumbing risers and at each floor (above or below floor slabs). Friction clamps installed above floor slabs shall not be supported from or rest on floor sleeves.
 - c. Provide hangers at a maximum distance of two feet from all changes in direction (horizontal and vertical) and on both sides of concentrated loads independent of the piping.

- d. Hangers, in general, for all horizontal piping shall be Clevis type hangers. These hangers shall be sized to fit the outside diameter of the pipe insulation and insulation protectors (sheet metal shields) specified herein. For sprinkler/stand pipe systems, hanger shall be approved black malleable iron, heavy duty pattern having two (2) parts bolted together.
 - e. All vertical drops and runouts including insulated pipes shall be supported by split ring hangers with extension rods and wall plates. These hangers shall be copper plated when used on uncovered copper tubing. Supports on insulated vertical piping shall be sized to fit the outside diameter of the pipe insulation with 360 degrees insulation protector.
 - f. Provide on each horizontal insulated lines, pipe covering protectors (shields) at each hanger. Each protector shall be sized to fit the outside diameter of the pipe insulation.
 - g. Retaining straps shall be provided with all beam clamps.
 - h. All supplementary steel, including factory fabricated channels, associated accessories, and 12 inch long sheetmetal shields, throughout the project for this Section of the Specifications, both suspended and floor mounted, shall be provided by Plumbing Subcontractor and shall be subject to the approval of the Engineer.
 - i. Hangers shall not pierce the insulation on any insulated pipe.
 - j. Wire, tape or wood fastenings for shims or support of any pipe or tubing shall not be used.
 - k. Remove all rust from the ferrous hanger equipment (hangers, rods, and bolts) and apply one coat of red lead immediately after erection.
 - l. Piping at all equipment and each control valve shall be supported to prevent strains or distortions in the connected equipment and control valves. Piping at equipment shall be supported to allow for removal of equipment, valves and accessories with a minimum of dismantling and without requiring additional support after these items are removed.
 - m. All piping shall be independently supported from the building structure and not from the piping, ductwork, conduit or ceiling suspension systems of other systems.
 - n. Installation of hangers which permit wide lateral motions of any pipe will not be acceptable.
 - o. "C" clamps installed with pipe hangers or equipment hangers will not be permitted unless provided with retaining straps.
 - p. All no hub cast iron pipe 6 inches or larger in diameter shall be braced to prevent horizontal movement as recommended by the Cast Iron Soil Pipe Institute by using braces, blocking or rodding as illustrated in the CISPI Handbook, Vol. II, Specification Section 310.
- C. Pipe Covering Installation
- 1. Before pipe covering is applied, all pressure tests shall have been performed and approved by the Local Plumbing Inspector.
 - 2. Pipe covering shall be applied over clean, dry surfaces.
 - 3. Pipe covering shall be continuous and shall be carefully fitted with side and end joints butted firmly and tightly together and finished as specified herein.
 - 4. Pipe covering and auxiliaries shall be kept dry during storage and application.
 - 5. Adhesives, cements and coatings shall not be applied when the ambient temperature is below 40 degrees Fahrenheit.
 - 6. Valve bodies shall have covering applied up to the stem.

7. It is the intent of this Specification that all vapor barriers be sealed and be continuous throughout. Staples shall not be used on vapor barrier jackets.
 8. Where pipe covering ends occur at equipment or fixtures, end caps on the covering shall be provided.
 9. Adequate operating clearances shall be provided at control mechanisms.
 10. Pipe covering for flanges shall overlap the adjoining pipe by a minimum of three inches on each side.
 11. Pipe covering shall be provided on all piping passing through ceilings and through the interior above ground sleeves (wall and floor).
 12. All voids and seams in insulation shall be filled with insulating cement and finished as specified herein.
 13. End joints of each section of the installed pipe covering shall be tightly butted.
- D. Installation of Sleeves, Inserts and Escutcheons (New and existing floors and walls)
1. Sleeves in floors shall be set one (1) inch above the finished floor surface or as indicated on the Architectural Drawings.
 2. Sleeves through interior masonry or non masonry walls or partitions shall be set flush with the finished surfaces of the wall or partition.
 3. Field drilling for inserts required for work under this Section of the Specifications shall be provided by Plumbing Subcontractor.
 4. Each interior wall or partition sleeve shall be packed with foam or glass wool to within one inch of each face of wall, and the remaining portion of each end of sleeve to be sealed with U.L. listed fire proof caulking compound equal to the rating of the partition.
 5. Escutcheons shall be installed around all exposed insulated or bare pipe, except water closet starts or bends passing through a finished floor, wall or ceiling. Escutcheons shall fit snugly around the bare pipe or insulated pipe.
- E. Valve Installation
1. Location of Valves: There shall be valves where indicated on the drawings and where specified as follows:
 - a. At building service entrances, foot of all supply risers, branches to groups of fixtures, branches to separate fixtures, equipment, wall hydrants, hose bibbs, connections to other systems and sectionalizing points in each system.
 - b. Each fixture supply shall have a separate angle stop or straight stop finished like the pipe it services.
 - c. Each piece of equipment shall have isolation valves for each service connected
 - d. At the foot of each riser, on the inlet and outlet side of control valves.
 - e. At the low points of each water system including trapped sections, provide a tee with 2 inch branch and valve with 3/4 inch hose end adapter and attached chain with cap.
 - f. Valves shall be located to permit easy operation, replacement or repair.
- F. Installation of Gauges and Thermometers

1. Thermometers and pressure gauges shall be installed in such a manner as to cause a minimum restriction to the flow in the pipes and so that they can be easily read from the floor.
2. Thermometers shall be installed in the outlet piping from the hot water heater.
3. Pressure gauges in the cold water system shall be installed at the water meter.
- G. Sewer Connections
 1. Connections to the site sewer within 10' of the building shall be in accordance with local regulations. Coordinate sewer inverts with the site contractor
- G. Drinking Water Cooling System Installation
 1. General: Provide water cooler with a bracket which shall be securely anchored to the wall in a manner suitable for the wall construction and weight to be carried.
- H. Pump Installation
 1. General: Install plumbing pumps where indicated on the drawings in accordance with manufacturer's published installation instructions.
 2. Access: Provide access space around plumbing pumps for service, but in no case less than that recommended by manufacturer.
 3. Support: Install base mounted pumps on minimum 4 inches high concrete base equal or greater than 3 times total weight of pump and motor, with anchor bolts poured in place. Set and level pump, grout under pump base with non shrink grout. Install in line pumps supported from piping system.
 4. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Verify that electrical wiring installation is in accordance with manufacturer's requirements.
 5. Piping Connections: Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated on the drawings.
 6. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.
 7. Start Up: Lubricate pumps before start up. Start up in accordance with manufacturer's instructions.
 8. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch up paint.
- I. Domestic Water Heater Installation
 1. General: Install domestic gas water heater in accordance with ANSI Z223.1 and the manufacturer's installation instructions.
 2. Support: Install gas water heater on pads oriented so that controls and devices needing service and maintenance have adequate access. Install water heaters level.
 3. Gas Supply: Provide gas pipe with drip leg, tee, gas gas cock and union. Provide gas pipe of size shown on drawings or the full size of unit inlet connection. Install piping so as not to interfere with service of units.
 4. Water Piping: Provide hot and cold water piping to units with shutoff valves and unions. Provide recirculating water line to unit with shutoff valve, check valve, and union.
- J. Floor Drain Installation
 1. Install floor drains in accordance with manufacturers written instructions and in locations indicated.

2. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with low point finished floor.
 3. Trap all drains connected to the sanitary sewer.
 4. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.
 5. Position drains so that they are accessible and easy to maintain.
- K. Installation of Trap Primers
1. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow.
- L. Roof Drain Installation
1. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.
 2. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.
 3. Position roof drains so that they are accessible and easy to maintain.
- M. Blending Valve Installation
1. All piping shall be thoroughly flushed before the blending valve is installed. Insure that hot and cold water piping are connected to proper
 2. Follow manufacturers instructions for setting of maximum allowable temperature limits allowed by code.
 3. Valve must be flowing when setting temperature.
- N. Grease Trap Installation
1. Grease traps shall be located so as to provide working access to the secured cover.
 2. In order to insure maximum efficiency a flow control fitting shall be provided on the inlet drain to insure that the flow does not exceed the maximum rating of the grease trap.
 3. Each grease trap shall be installed in accordance with the manufacturers written installation instructions.
- O. Installation of Pressure Reducing Valves
1. General: Install one or more pressure reducing valves on the main water line supplying plumbing fixtures.
 - a. The total capacity of each assembly shall be not less than the capacity specified.
 - b. Provide each pressure reducing valve with a gate valve and union on both the inlet and outlet connections.
 - c. A bypass one pipe size smaller than the main water line provided with a globe valve and union, shall be installed between the inlet and outlet sides of the pressure reducing valve assembly.

- d. Pressure gauges shall be installed at the inlet and outlet connections to the pressure reducing valve assembly. Gauges shall have T handle stops in their connections.
- P. Strainer Installation
1. General: Place strainers ahead of pressure reducing valves, automatic control valves, pumps, and elsewhere as indicated on the drawings or specified.
- Q. Installation of Cleanouts and Ferrules
1. Riser Connection to Sewer or Drain: Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main.
 2. Test Tees: Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.
 3. Cover Plates: Where cleanouts or test tees occur on concealed pipes in finished rooms, they shall be provided with a 1/8 inch thick, machine finished, brass cover plate of sufficient diameter to cover the opening in the finished wall or partition. The cleanout plug shall have a solid head, tapped for a 1/4 inch brass screw to secure the cover plate. Where cleanout plugs extend beyond the wall finish, the cover plates shall be of machine finished brass and shall be only of sufficient depth to fit against the wall to cover plug. Cleanout cover plates shall be painted to match adjacent wall finish.
 4. Cleanouts Plugs For Threaded Fittings: Cleanout plugs for threaded fittings shall be in accordance with ANSI B16.12. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5 inches and larger to reduce plug size to 4 inches; cleanout plugs for piping 4 inches and smaller shall be the same size as the pipe.
 5. Cleanout Plugs For Hub and Spigot Fittings: Cleanout plugs for hub and spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with ANSI B16.12, except that plugs required to be flush with the floor shall have square countersunk heads in lieu of raised heads.
 6. Cleanout Plugs for Copper Drainage Lines: Cleanout plugs on copper drainage lines shall be installed in solder joint fittings having threaded openings provided for the cleanout, or in solder joint fittings with threaded adapters.
- R. Installation of Plumbing Fixtures
1. General:
 - a. Refer to Architectural Drawings for locations and mounting heights of all plumbing fixtures, counter sinks, water fountains and showers.
 - b. Provide with all plumbing fixtures, all trim, supports, fittings, connections and all incidentals necessary to make a complete installation in accordance with plumbing codes and the Contract Documents.
 - c. All visible hanger nuts and all escutcheons shall likewise be chrome plated over nickel plate.
 2. Examination:

- a. Examine roughing-in for potable cold water and hot water supplies and soil, waste, and vent piping systems to verify actual locations of piping connections prior to installing fixtures.
 - b. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
 - c. Do not proceed until unsatisfactory conditions have been corrected.
3. Fixture Roughings
- a. Install rough plumbing including fixture carriers and supports, valves and water hammer arrestors within chase tolerances. Supply roughing through finish walls and at hose bibbs and shower heads shall be secure and free of movement. Locate valves and water hammer arrestors within 12 inches of approved access panel location.
 - b. Align exposed waste and supply pipe roughings with fixture connections within 1 inch tolerance. Provide flush valves in alignment with the fixture, without vertical or horizontal offsets. Obtain fixture manufacturer roughing data sheets for recommended roughing dimensions.
 - c. Provide fixture templates for casework contractor for counter mounted sinks and lavatories.
 - 1) Rough handicapped use water closets to locate the flush valve handle on the wide side of the toilet stall.
 - d. Secure fixture supports to floor slab construction with lag bolts and metal expansion shields to support at least 250 pounds on the front rim of the fixture for 5 minutes.
 - e. Mounting Heights: Coordinate with Architectural Details
4. Fixture Supports
- a. All fixtures (including drinking fountains) shall be supported and fastened to the building structure. The method of support for each type fixture shall be specified herein, except when the fixture designations on the Contract Drawings indicate modifications.
 - b. Wall hung water closets shall be generally supported on combination drainage fittings and chair carriers and with foot supports fastened to the floor slab with expansion lag screws.
 - c. Urinals shall be supported by floor mounted carrier with support plate, bearing plate, adjustable extension, tubular uprights, block bases and chrome plated trim.
- d. Installations shall be complete with all necessary bolts, nuts and washers, iron or brass connecting nipples between fixtures and piping system of the proper length and graphite non-asbestos gaskets for closet connections.
 - e. Where wall hung fixtures are secured to masonry walls or partitions, they shall be fastened with 1/4 inch through bolts provided with nuts and washers at back. Bolt heads and nuts shall be hexagon and exposed bolts, nuts, washers and screws shall be chromium plated brass.
 - f. Where secured to concrete or brick walls, they shall be fastened with brass bolts or machine screws in lead sleeve type expansion shields and shall extend at least three inches into solid concrete or brick work, except fixtures specified to be supported or chair carriers.

- S. Installation of Fixtures
- a. Mount fixtures level at elevations shown on architectural drawings. Refer to toilet room elevations and casework details.
 - b. Install handicapped use fixtures in accordance with the requirements to the Architectural Access Board Code and ANSI A117.1. Insulate hot water supply and waste piping under lavatories.
 - 1) Where urinals are provided: Install one urinal with the rim mounted above the finish floor in compliance with the handicapped code. Coordinate architectural drawing for mounting height.
 - c. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.
 - d. Caulk deck-mounted trim at the time of assembly, including fixture and casework mounted. Caulk self-rimming sinks installed in casework.
- T. Fixture Trim:
- a. All materials specified to be chromium plated shall be thoroughly cleaned and polished before plating, and plate shall be heavily, thoroughly and evenly applied, guaranteed not to strip or peel.
 - b. Where escutcheons are not furnished with plumbing fixtures, Plumbing Subcontractor shall supply them. Escutcheons shall be the type and material specified herein.
 - c. Each fixture shall be separately trapped using the type and size of trap specified herein and required by the Plumbing Code.
 - d. Unless otherwise specified, faucets and all exposed fittings shall be chromium plated. Chromium plating for brass shall be applied on a first plating of nickel.
 - e. All fixtures requiring hot and cold water shall have the cold water faucet on the right hand side of the fixture and the hot water faucet on the left hand side of the fixture.
 - f. All brass shall conform to brass tubing and shall be not less than No. 17 gauge.
- U. Adjustments and Cleaning
- a. After completion of the installation work and equipment start-ups, perform the necessary adjustments to systems installed under this Section. Submit verification that systems are operating at the specified temperatures and pressures.
 - b. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
 - c. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.
 - d. Adjust water pressure at drinking fountains, electric water coolers, and faucets, shower valves, and flushometers having controls, to provide proper flow and stream.
 - e. Replace washers of leaking and dripping faucets and stops.
 - f. Adjust flush valves, open fixture stops, and clean faucet aerators.
 - g. Set aquastats on water heaters and circulation pumps.
 - h. Temperature adjustments: Adjust pressure balanced mixing valves at showers to provide a maximum temperature of 112 degree F. Adjust metering faucets in public toilet rooms to provide a maximum temperature of 110 degree F.
 - i. Clean fixtures, fittings, and spout and drain strainers with manufacturers' recommended cleaning methods and materials.

V. Protection

- a. Provide protective covering for installed fixtures and fittings.
- b. Do not allow use of fixtures for temporary facilities, except when approved in writing by Project Manager.

3.11 INSTALLATION OF AIR INTAKE AND FLUE STACKS

- A. Install all gas vents/intakes in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.
- B. Seal joints between sections of positive pressure vents in accordance with manufacturer's installation instructions, and using only sealants recommended by manufacturer.
- C. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances. Provide guy wires on all vents which terminate through roof.
- D. Install barometric and thermostatically operated dampers in accordance with manufacturer's instructions. Locate as close to draft hood collar as possible.
- E. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.
- F. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.

3.12 SYSTEM SHUTDOWNS

- A. Coordinate shutdowns of existing systems with the Owner and submit a written request at least ten working days in advance. Minimize system shut downs as much as possible. Submit a list of all affected areas, the proposed work to be performed, and the expected length of the shut-down including time for retesting.
- B. Provide temporary services to maintain active system during extended shut-downs as required for demolition and construction phasing.

END OF SECTION

Section 22 00 01
PLUMBING TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
1. Specification requirements for Trade Contract "PLUMBING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 22 00 00 - PLUMBING
 - b. Section 23 00 01 - PLUMBING TRADE CONTRACT REQUIREMENTS
 - c. Section 22 05 48 - VIBRATION CONTROL.
 - d. Section 22 08 00 - Commissioning of Plumbing
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.

CLASSES OF WORK REFERENCE	PARAGRAPH
Insulation	22 00 00- 2.5

- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.
- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:

1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A102, A103, A101C, A102C, A103C, A200, A544, S000, S101C, S102C, S103C, S104C, LS001, LS101, LS102, LS103, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A425, A440, A441, A426, A181, A181A, A181B, A181C, A181D, A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A101A, A101B, A101D, A102A, A102B, A102D, A103A, A103B, A700, A453, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, TE000, TE001, TE111, TE112, TE121, TE122, TE141, FS100, FS101, FS102, FS103, S302, S001, S002, S003, S101A, S101B, S101D, S101L, S102A, S102B, S102D, S103A, S103B, S103D, S104B, S104D, S105B, S105C, S200, S201, S202, S203, S204, S205, S300, S301, S303, S304, S305, S400, S401, S500, S501, S502, S503, S504, S600, S601, S602, S603, S604, S700, S701, C 2.1, C 2.3, C 4.0, C 4.1, C 4.2, C 6.0, C 6.1, C 6.2, VS101, A104, A480, A401, A402, A403, A404, A405, A406, A400, A442, A600, A605, A604, A461, A602, A603, A313, A314, A319, A320, A321, A322, P001, P101A, P101B, P101C, P101D, P102A, P102B, P102C, P102D, P103A, P103B, P103C, P103D, A450, A460, A511, A111A, P002, P003, P004, P005, P100A, P100B, P100C, P100D, P400, P401, P402, P403
 2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
 3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- G. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Trade.
- H. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE
CONTRACTOR: _____
TRADE CONTRACT FOR TRADE: PLUMBING.
 2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.
- 1.3 RELATED REQUIREMENTS
- A. Section 10 28 13 - TOILET ACCESSORIES
 - B. Section 11 40 00 - FOODSERVICE EQUIPMENT.
 - C. Section 11 53 00 - LABORATORY EQUIPMENT.
 - D. Section 11 53 13 - LABORATORY FUME HOODS.

- E. Section 12 36 53 - LABORATORY COUNTERTOPS
 - F. Section 21 00 00 - FIRE PROTECTION
 - G. Section 22 00 00 - PLUMBING TRADE CONTRACT REQUIREMENTS
 - H. Section 23 00 00 - HVAC
 - I. Section 26 00 10 - ELECTRICAL
- 1.4 EXAMINATION OF SITE AND DOCUMENTS
- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.
- 1.5 MEETINGS AND CONFERENCES
- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.
- 1.6 SEQUENCING
- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.
 - B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
 - C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS

– APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.

2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.

B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:

1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed, operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

Section 22 08 00

COMMISSIONING OF PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.

1.2 SUMMARY

- A. This section includes commissioning process requirements for Plumbing systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

- A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.
- B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:
- C. Certificates of readiness
- D. Certificates of completion of installation, prestart, and startup activities.
- E. O&M manuals
- F. Test reports

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the contractor for the equipment being tested. For example, the plumbing contractor of Division 22 shall ultimately be responsible for all standard testing equipment for the plumbing system in Division 22, except for equipment specific to and used by TAB in their commissioning responsibilities.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems.
- B. Red-lined Drawings: The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.
- C. Operation and Maintenance Data: Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the contractor.
- D. Demonstration and Training: Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the contractor to the CxA four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior to the training session.

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Perform tests as required by Division 22.
- B. Attend construction phase controls coordination meetings as required.
- C. Participate in Plumbing systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- D. Provide information requested by the CxA for final commissioning documentation.
- E. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- F. Prepare preliminary schedule for Plumbing system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.
- G. Update schedule as required throughout the construction period.
- H. Assist the CxA in all verification and functional performance tests.

-
- I. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
 - J. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.
 - K. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
 - L. Notify the CxA a minimum of two weeks in advance of the time for start of the balancing work..
 - M. Participate in, and schedule vendors and contractors to participate in the training sessions.
 - N. Provide written notification to the CM/GC and CxA that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
 - 1. Plumbing equipment including domestic water heaters, controls, pumps, valves plumbing fixtures, and all other equipment furnished under this Division.
 - O. The equipment supplier shall document the performance of his equipment.
 - P. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.
 - Q. Balance Contractor
 - 1. At the completion of the balancing work, and the submittal of the final balancing report, notify the Plumbing contractor and the CM/GC.
 - R. Equipment Suppliers
 - 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
 - 2. Assist in equipment testing per agreements with contractors.
 - 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.
 - S. Refer to Division 01 Section "General Commissioning Requirements" for additional contractor responsibilities.
- 3.3 CxA'S RESPONSIBILITIES
- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.4 TESTING PREPARATION

- A. Certify in writing to the CxA that Plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify in writing to the CxA that Plumbing instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify in writing that balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.5 DOMESTIC WATER BALANCING

- A. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness balancing Work.

3.6 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of Plumbing testing shall include entire Plumbing installation. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the Plumbing contractor, balancing subcontractor shall prepare detailed testing plans, procedures, and checklists for Plumbing systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.

-
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
 - G. The CxA may direct that set points be altered when simulating conditions is not practical.
 - H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
 - I. If tests cannot be completed because of a deficiency outside the scope of the Plumbing system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
 - J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.7 PLUMBING SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 22 sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. Plumbing Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 22 Sections. Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 22 piping Sections. Plumbing Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Plumbing Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of domestic water distribution systems.

-
- E. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls as required.
 - F. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

<i>Plumbing Systems</i>
Natural gas systems
Backflow preventers
Water heaters
Hot water storage
Recirculation pumps
Water closets and sinks
Laboratory waste and acid neutralization systems
Safety shower/eyewash stations
Mixing valves

- 3.8 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT
 - A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.
- 3.9 APPROVAL
 - A. Refer to Division 01 Section "General Commissioning Requirements" for approval procedures.
- 3.10 DEFERRED TESTING
 - A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deferred testing.
- 3.11 OPERATION AND MAINTENANCE MANUALS
 - A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
 - B. Refer to Division 01 Section "General Commissioning Requirements" for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.

3.12 TRAINING OF OWNER PERSONNEL

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to training.

End of Section

Section 23 00 00
HEATING, VENTILATING & AIR-CONDITIONING (HVAC)
(TRADE CONTRACT REQUIRED AS PART OF SECTION 23 00 01)

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Section 23 00 00
HEATING, VENTILATING & AIR-CONDITIONING (HVAC)
(TRADE CONTRACT REQUIRED AS PART OF SECTION 23 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.
- B. Equality of material, article, assembly or system other than those named or described in this Section shall be determined in accordance with the provisions of the CONTRACT AND GENERAL CONDITIONS.
- C. Trade Contract Requirements: As provided under Section 23 00 01 – HEATING, VENTILATING AND AIR CONDITIONING TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
- D. Work of this Filed Sub-Bid includes all individual specification sections listed in Section 23 00 01.

1.2 DEFINITIONS

- A. Most terms used within the documents are industry standard. Certain words or phrases shall be understood to have specific meanings as follows:
 - 1. Provide: Furnish and install completely connected up and in operable condition.
 - 2. Furnish: Purchase and deliver to a specific location within the building or site.
 - 3. Install: With respect to equipment furnished by others, install means to receive, unpack, move into position, mount and connect, including removal of packaging materials.
 - 4. Conduit: Raceways of the metallic type which are not flexible.
 - 5. Connect: To duct, pipe or wire up, including all branch ductwork, piping, and/or circuitry, control and disconnection devices so item is complete and ready for operation.
 - 6. Subject to Mechanical Damage: Equipment, ductwork, piping and raceways installed exposed and less than eight feet above finished floor in mechanical rooms or other areas where heavy equipment may be in use or moved.
 - 7. General Contractor and Construction Manager are one in the same.

1.3 DESCRIPTION OF WORK

- A. The work described herein shall be interpreted as work to be done by the HVAC Subcontractor. Work to be performed by other trades will always be specifically referenced to that trade.

- B. Furnish all staging, rigging, temporary support, labor, materials, and perform all operations in connection with the installation of the HVAC work. Refer to Section 015000 for coordination of requirements by this trade contractor.
- C. Without limiting the generality thereof, the work to be performed under this section includes complete new HVAC systems with the following major sub systems:
 - 1. Low Pressure Hot Water, Chilled Water Piping, Make-Up Water, Condensate Insulation and accessories
 - 2. Refrigeration Piping
 - 3. Power & Gravity Ventilators
 - 4. Ductwork With Insulation, Diffusers, Registers And Grilles
 - 5. Terminal Heating Units including Unit Heaters, Fintube Radiation, Radiant Panels and Electric unit heaters.
 - 6. Pumps and Accessories
 - 7. Boilers
 - 8. Air Cooled Chillers
 - 9. Rooftop Units
 - 10. Variable Air Volume Units
 - 11. Ductless Cooling Unit Systems
 - 12. Sound Attenuators and Acoustic Liner
 - 13. Condensate Pumps
 - 14. Direct Digital Automatic Temperature Controls
 - 15. Testing and Balancing
 - 16. Water/Chemical Treatment
 - 17. Vibration and Seismic Components
- D. Refer to Section 230548 "Vibration Control and Seismic Restraint" for additional work to be provided under this Section 230000.
- E. Refer to Section 078400 – FIRESTOPPING for additional work to be provided under this Section 230000.
- F. It shall be the responsibility of this Division 230000 to provide all personnel to fully coordinate with the commissioning agent. The hours of training and instruction outlined in this Division 230000 and the testing requirements shall be in addition to those tests and requirements outlined in SECTION 019113 – GENERAL COMMISSIONING REQUIREMENTS and required to fulfill Section 230800 -- COMMISSIONING OF HVAC SYSTEMS.
- G. Include the following work as needed to perform the work of this section.
 - 1. Core drilling in accordance with SECTION 017329 – CUTTING AND PATCHING.
 - 2. Cutting through non masonry and masonry construction in accordance with SECTION 017329 – CUTTING AND PATCHING.

3. Temporary facilities, including but not limited to stairs and ladders, staging, scaffolding, rigging, chutes and hoisting in accordance with SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS.
 4. Fire and smoke stop systems in accordance with SECTION 078400 – FIRESTOPPING.
 5. Furnish access doors and frames in accordance with SECTION 083100 – ACCESS DOORS AND FRAMES.
- H. For LEED requirements refer to SECTION 018110 – SUSTAINABLE DESIGN REQUIREMENTS, SECTION 018119 – INDOOR AIR QUALITY REQUIREMENTS and SECTION 018120 – CONSTRUCTION INDOOR AIR QUALITY (IAQ) MANAGEMENT.
- I. For Mechanical system commissioning refer to SECTION 230800 – COMMISSIONING OF HVAC SYSTEMS.
- J. Change all air handling unit (RTU, HVU, MAU, UH, DCU) filters as required by SECTION 018119 INDOOR AIR QUALITY REQUIREMENTS flush out procedures and adhere to IAQ Management Procedures.
- K. Sustainable Design Intent: Comply with project requirements intended to achieve a minimum score measured and documented according to SECTION 018110 – SUSTAINABLE DESIGN REQUIREMENTS. Project scores will be verified by a third party certifier.
1. Refer to Section 018110 – SUSTAINABLE DESIGN REQUIREMENTS for material, procedure, and documentation submittal requirements.
 2. High efficiency filters – Install MERV 13 filters in all HVAC equipment requiring filtration media immediately prior to occupancy.
 3. Air intake location – Locate outside air intake openings a minimum of 25 ft. from any hazard or noxious contaminants such as chimneys, plumbing vents, streets, alleys, parking lots, and loading docks. The distance between exhaust air or vent outlets and air intakes should be the greater of 25 ft. or the distance as determined by MA State Building Code Equation 2801.2.2.2. Exception, when locating an air intake within 25 ft. of a contaminant source is unavoidable, such opening shall be a minimum of 2 ft. below the contaminant source and 10 ft. horizontally from the nearest edge of the air intake to the nearest edge of the contaminant source. All intakes must be 6 ft. above landscaped grade including soil, lawn, shrubs, or any plant life within 1.5 ft. horizontally of intake.
 4. Electric ignition for gas-fired equipment. Standing pilot lights in gas-fired equipment are prohibited. All gas-fired equipment shall utilize electric ignitions to light gas burners.
 5. All air conditioning equipment provided under this project shall meet or exceed mechanical equipment efficiency requirements outlined by the IECC Energy Code and Advanced Buildings-Benchmark Criteria. Refer to LEED Version 4, Appendix A for efficiency values. If mechanical equipment efficiencies specifically listed on the drawings are higher than the LEED or Advanced Building Requirements, the higher efficiency equipment must be provided.

1.4 RELATED WORK UNDER OTHER SECTIONS

- A. The following work is included in other sections. Coordinate the work of this section as required per those sections.
- B. Cutting beyond the requirements as stated herein, and patching of all openings regardless of size, is specified in the respective Sections of the trade responsible for furnishing and installing similar new materials.
- C. For temporary controls refer to SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS. If Owner authorizes use of the permanent HVAC system for temporary use during construction, provide temporary controls to adequately control the unit and not void the warranty. Coordinate extent of temporary controls with Construction Manager. Use of the new equipment for temporary heat/cooling will not start product warranty until substantial completion is achieved. Clean unit, strainers, ductwork and change filters prior to using equipment for building occupancy by the owner.
- D. For flashing of vents/pipes through roof/walls and setting of roof curbs and flashing and waterproofing of such, refer to Section DIVISION 07 – THERMAL AND MOISTURE PROTECTION.
- E. For power wiring of mechanical equipment refer to Section 260010.
- F. For excavation and backfill of below grade mechanical and related systems refer to DIVISION 31 – EARTHWORK.
- G. For structural steel refer to SECTION 051200 – STRUCTURAL STEEL FRAMING.
- H. For firestopping not called for in this Section refer to SECTION 078400 – FIRESTOPPING.
- I. For finished painting of mechanical systems not called for in this Section refer to SECTION 099100 – PAINTING AND COATING.
- J. For Food Service Equipment refer to SECTION 114000 – FOODSERVICE EQUIPMENT.
- K. For interior concrete work relating to this Section refer to SECTION 033001 – CAST-IN-PLACE CONCRETE.
- L. For exterior concrete work relating to this Section refer to SECTION 033001 – CAST-IN-PLACE CONCRETE.
- M. Installation of hollow metal doors and frames refer to SECTION 081110.
- N. For LEED requirements refer to Section 018113 – SUSTAINABLE DESIGN REQUIREMENTS.
- O. For mechanical system commissioning refer to Section 01 91 13 – General Commissioning Requirements and Section 230800 Commissioning of HVAC Systems.

- P. Change all air handling unit (RTU, HVU, MAU, UH, DCU) filters as required by Section 018119 - INDOOR AIR QUALITY REQUIREMENTS flush out procedures and adhere to IAQ Management Procedures.

1.5 COMMISSIONING

- A. Where indicated in the equipment or commissioning specifications, engage a factory-authorized service representative, to perform startup service as per functional test sheets and requirements of Section 019113 –Commissioning General Requirements and Section 230800 – Commissioning of HVAC Systems.
- B. Complete installation and startup checks and functional tests according to Section 019113 –Commissioning General Requirement, Section 230800 –Commissioning of HVAC Systems, and manufacturers written instructions.
- C. Operational Test: After HVAC system has been energized, start units to confirm proper unit operation. Rectify malfunctions, replace defective parts with new one and repeat the start-up procedure.
- D. Verify that equipment is installed and commissioned as per requirements of Section 019113, Section 230800, and manufacturers written instructions/requirements.

1.6 CODES, ORDINANCES, AND PERMITS

- A. Perform all work in accordance with the requirements of Framingham Building Department, State of Massachusetts Building Code, latest Edition, and applicable State and Federal Laws. Give all requisite notices, file all requisite plans, and obtain all permits required to perform HVAC Work.
- B. Permits: Be responsible for filing documents, and securing of inspection and approvals. Pay all local connection and permit fees. Costs related to temporary service, refer to Section 015000. Refer to AIA 201 General Conditions.
- C. All HVAC equipment shall be installed to meet all State, Local and Federal sound ordinances.

1.7 QUALITY ASSURANCE

- A. Codes and Standards:
 - 1. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI Hydraulic Institute Standards".
 - 2. UL Compliance: Design, manufacture, and install HVAC pumps in accordance with UL 779 "Motor Operated Water Pumps".
 - 3. ANSI Standards: Comply with ANSI A13.1 for pipe, valve, and equipment identification.
 - 4. I=B=R Compliance: Provide boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast Iron and Steel Heating Boiler", and bear I=B=R emblem on nameplate affixed to boiler.
 - 5. NFPA Compliance: Install boilers in accordance with NFPA Standard 54.

6. ASME Compliance: Construct boilers in accordance with ASME Boiler and Pressure Vessel Code, Section IV "Heating Boilers".
 7. UL and NEMA Compliance: Provide boiler ancillary electrical components and safety control devices, which have been listed and labeled UL, and comply with NEMA Standards.
 8. FM Compliance: Provide control devices and control sequences in accordance with requirements of Factory Mutual System (FM).
 9. IRI Compliance: Provided control devices and control sequences in accordance with requirements of Industrial Risk Insurance (IRI).
 10. AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.
 11. AGA Compliance: Provide gas controls and devices in accordance with American Gas Associates.
 12. ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", display certification symbol on units of certified models.
 13. ASHRAE Compliance: Construct and install refrigerant coils in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
 14. NFPA Compliance: Provide air handling unit internal insulation having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
 15. UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA standards.
 16. NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.
 17. LEED: Install all HVAC systems in accordance with all current requirements.
- B. MSS Standard Practices: Comply with the following standards for valves:
1. MSS SP-45: Bypass and Drain Connection Standard
 2. MSS SP-67: Butterfly Valves
 3. MSS SP-70: Cast Iron Gate Valves, Flanged and Threaded Ends
 4. MSS SP-71: Cast Iron Swing Check Valves, Flanged
 5. MSS SP-72: Ball Valves with Flanged or Butt-Welding Ends for General Service
 6. MSS SP-78: Cast Iron Plug Valves, Flanged and Threaded Ends
 7. MSS SP-80: Bronze Gate, Glove Angle and Check Valves
 8. MSS SP-84: Steel Valves - Socket Welding and Threaded Ends
 9. MSS SP-85: Cast Iron Globe and Angle Valves, Flanged with Threaded Ends
 10. MSS SP-92: MSS Valve User Guide

- C. Automatic Temperature Control Contractor Qualifications: Branch Factory Owned Authorized dealers specializing in manufacturing and installation of control systems for not less than 5 years.
 - 1. Codes and Standards:
 - a. Electrical Standards: Provide electrical components of control systems which have been UL-listed and labeled, and comply with NEMA standards.
 - b. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.8 HAZARDOUS MATERIALS

- A. The HVAC Contractor shall be responsible for removing and legally disposing of any and all hazardous waste associated with HVAC systems, including but not limited to:
 - 1. All chemical treatment used in flushing out HVAC piping systems.
 - 2. Un-used excess material such as adhesives used in ductwork and piping installations.
 - 3. Refrigerant in all AC systems.
 - 4. Glycol in Heating and Cooling Systems.
 - 5. Items specifically noted on drawings.

1.9 DISCREPANCIES IN DOCUMENTS

- A. Where Drawings or Specifications conflict or are unclear, advise Architect in writing before Award of Contract. Otherwise, Architect's interpretation of Contract Documents shall be final, and no additional compensation shall be permitted.
- B. Where Drawings or Specifications do not coincide with manufacturers recommendations, or with applicable codes and standards, alert Architect in writing before installation.
- C. If the required material, installation and work can be interpreted differently from drawing to drawing, or between drawings and specs, the HVAC Subcontractor shall provide that material, installation and work which is of the more stringent.
- D. It is the intent of these contract documents to have the contractor provide systems and components that are fully complete and operational and fully suitable for the intended use. There may be situations in the documents where insufficient information exists to precisely quantify and/or describe a certain component or subsystem, or the routing of a system. In cases such as this, where the contractor has failed to notify the Architect of the situation in accordance with Paragraph (A) above, the contractor shall provide the specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner and per local and state codes.

1.10 CONTRACT DRAWINGS

- A. All work shown on the drawings is intended to be approximately correct to scale, but shall be taken in a sense as diagrammatic. Sizes of ductwork and pipes and general method of running them are shown, but it is not intended to show every offset and fitting. To carry out the true intent and purpose of the plans, furnish all necessary parts to make complete working systems ready for use.
- B. The HVAC Drawings and Specifications are intended to supplement each other so that any details shown on the Drawings and not mentioned in the Specifications, or vice-versa, shall be executed the same as if mentioned in the Specifications and shown on the Drawings.
- C. Refer to the Architectural, Structural, Mechanical, Plumbing, Fire Protection and Electrical Drawings which indicate the construction in which this work shall be installed. Locations shown on the plans shall be checked against the general and detailed Drawings of the construction documents. All measurements must be taken at the building/field.

1.11 COORDINATION DRAWINGS

- A. Coordination requirements specific to the Work of this Section include the following:
 - 1. Before materials are purchased or work is begun, the respective Subcontractor shall prepare and submit to the Architect Coordination Drawings showing the size, elevation and location of his equipment, fixtures, ductwork, conduit, and piping lines relevant to the complete system. He shall ensure that these drawings are compatible and correctly annotated and cross-referenced at their interfaces.
 - 2. Coordination drawings are for the Contractor's and the Architect's use during construction and shall not be construed as replacing any shop or record drawings required elsewhere in the Contract Drawings.
 - 3. All coordination drawings shall be prepared in a large enough scale to accurately identify work of each trade and in addition to each sub-contractors systems, shall also show architectural floor plan, reflected ceiling plan, and structural framing with grid identification.
 - 4. The coordination drawing shall be prepared in AutoDesk Revit (2019 or later) and shall be started by the sheet metal sub-contractor and after applying all ductwork, the drawing shall be submitted for ductwork approval by the engineer. After approval, the drawing shall be circulated to the remaining sub-contractors for application of their work.
 - 5. During coordination drawing preparation the sub-contractors shall meet periodically to discuss overall coordination of all sub systems, and shall adjust their systems accordingly. When all drawings are complete the general contractor shall submit to the architect and engineers for review.
 - 6. Areas of conflict that cannot be resolved between the sub-contractor must be flagged on the drawings with adequate information to assist the architect and engineer in resolving noted issues.
 - 7. Cost for additional time to redraw areas in conflict will be completed at no cost to the owner or project.

- B. Refer to Section 013100 – PROJECT MANAGEMENT AND COORDINATION of these Contract Documents for general requirements and additional procedures relative to the preparation of Coordination Drawings.

1.12 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance as well as code required clearances. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing and provide code required clearances.
- B. Extend all grease fittings to an accessible location.

1.13 ROUGH IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected. Costs associated with modifications to systems due to lack of field coordination with other trades and building components shall be borne by this contractor.

1.14 PHASING

- A. The mechanical subcontractor shall construct the subject project in phases as directed by the Architect to suit the project progress schedule, as well as the completion date of the project.
- B. For additional information related to phasing, review the General Conditions and Supplementary Conditions and the Architectural drawings.

1.15 NOTIFICATION OF RELATED TRADES

- A. Notify all other trades responsible for installing chases, inserts, sleeves, anchors, louvers when ready for such installation and for final checking immediately before concrete is placed. Cooperate with such trades to obtain proper installation.
- B. Leave openings in walls for pipes, and ducts for mechanical and electrical work as shown on drawings or required by layout of mechanical or electrical systems.

1.16 MECHANICAL INSTALLATIONS

- A. Coordinate mechanical equipment and materials installation with other building components before installing.
- B. Verify all dimensions by field measurements.
- C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.

- E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building. Costs associated with modifications to systems due to lack of field coordination with other trades and building components shall be borne by this contractor.
- F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate connection of mechanical system with overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

1.17 CUTTING AND PATCHING

- A. Penetrations through construction as required for the work of this Section:
 - 1. Coring: Perform all coring for required work.
 - 2. Notify Masonry Sub-Contractor of exact locations and sizes for openings required in masonry, to be executed under Section 042000 – UNIT MASONRY, utilizing lintels furnished per Section 055000 – METAL FABRICATIONS.
 - 3. Cut openings in new non-masonry construction where required for penetrations. All cutting shall conform to the requirements of Section 017329 – CUTTING AND PATCHING.
- B. Patching at penetrations through construction as required for the Work of this Section:
 - 1. Notify Masonry Sub-Contractor when work is complete at penetrations through masonry construction, and ready for patching under Section 042000 – UNIT MASONRY.
 - 2. Notify appropriate Sub-Contractors when work is complete at penetrations through non-masonry construction, and ready for patching under Sections in Division 09 - FINISHES.
- C. Throughout the performance of the cutting and coring work, ensure that the structural integrity of the existing walls, floors, overhead structure, and other structural components, which are to remain, is maintained until permanent work is installed. Prior to any coring or cutting verify all locations of same with the General Contractor. All cutting and coring is to be performed in accordance with approved coordination drawings. All cutting or coring of structural must receive approval of the Architect prior to proceeding.
- D. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.

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- E. Patching of surfaces shall be by the trade responsible for the surface penetrated.
 - F. Refer to related architectural sections including Section 013100 for additional reference.

1.18 SUBMITTALS

- A. General: Refer to Section 013300 – SUBMITTAL PROCEDURES for general requirements for submittal of product data, shop drawings and other materials for review by the Architect and their Consultants. The following paragraphs supplement the requirements of Section 013300.
- B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by the General Contractor. Data submitted by Sub-contractors and material suppliers directly to the Architect/Engineer will not be processed.
- C. Submittal requirements specific to the Work of this Section include the following:
 - 1. Valves
 - 2. Meters and Gages
 - 3. Hangers and Attachments
 - 4. Mechanical Identification
 - 5. Mechanical Insulation
 - 6. Hydronic Piping and Accessories
 - 7. Water/Chemical Treatment
 - 8. Glycol Feeders
 - 9. Refrigeration Piping
 - 10. Boilers
 - 11. Air Cooled Chillers
 - 12. Pumps and Accessories
 - 13. Terminal Heating Units (HW & Elec)
 - 14. Ductless Cooling Unit Systems
 - 15. Power and Gravity Ventilators
 - 16. Metal Ductwork
 - 17. Ductwork Accessories
 - 18. Duct and Piping Pressure Testing Reports
 - 19. Air Outlets and Inlets
 - 20. Sound Attenuators and Sound Lining
 - 21. Condensate Discharge Pumps
 - 22. Automatic Temperature Controls
 - 23. Testing, Adjusting, Balancing, and Commissioning
- D. If a Shop Drawing is not accepted after two submissions, a third submission from the same manufacturer will not be considered.

- E. Check Shop Drawings and other submittals to assure compliance with contract documents before submittal to A/E.
- F. Review of Shop Drawings is final and no further changes shall be considered without written application. Shop Drawings review does not apply to quantities, nor relieve the HVAC Subcontractor of his responsibility for furnishing materials or performing his work in full compliance with these Contract Drawings and Specifications. Review of these shop drawings shall not be considered a guarantee of the measurements of this building or the conditions encountered.

1.19 SUBSTITUTIONS

- A. Refer to, Section 012513 – SUBSTITUTION PROCEDURES for requirements in requesting substitutions. The following paragraphs supplement the requirements of Section 012513
- B. If materials or equipment are substituted for basis of design specified items that alter the systems shown or its physical characteristics, or which have different operating characteristics, clearly note the alterations or difference and call it to the attention of the Architect/Engineer. Contractor shall be responsible for coordinating dimensional fit of equipment that varies from basis of design equipment. Under no circumstances shall substitutions be made unless material or equipment has been successfully operated for at least three consecutive years.
- C. Any modifications to the design, as a result of approving a substitution from the basis of design equipment, shall be the responsibility of the HVAC Subcontractor. Any additional cost to the HVAC Subcontractor or any other contractor, directly or indirectly, as a result of such substitutions, shall be the responsibility of the HVAC Subcontractor.

1.20 PRODUCT LISTING

- A. Prepare listing of major mechanical equipment and materials for the project.
- B. Provide all necessary information.
- C. Submit to the A/E through the General Contractor, within 20 days of signing contract, this listing indicating all equipment and manufacturers, as a part of the submittal requirement. If the product list is not submitted, it will be the responsibility of the subcontractor to submit one of the three named equal manufacturers.
- D. When two or more items of same material or equipment are required they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
- E. Provide products, which are compatible within systems and other connected items.

1.21 NAMEPLATE DATA

- A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, mode, number, serial number, capacity, operating, and power characteristics labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

1.22 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section General Conditions for delivery, storage, and handling of equipment. The following paragraphs supplement the requirements of Section General Conditions.
- B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- C. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
- D. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.
- E. All ductwork stored on site or off site shall have its ends sealed to prevent dust and debris from entering the ductwork.

1.23 RECORD DOCUMENTS

- A. General: Refer to Section 017839 - PROJECT RECORD DOCUMENTS, for general requirements for maintaining as-built drawings and submitting final reproducible record documents. The following paragraphs supplement the above.
- B. Provide Record Drawings for the Work of this Section and include the following: Provide electronic AutoCAD drawings and hard copy to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column line; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located. Also provide ATC Drawings showing As-Built conditions, modified sequences, field changes and any additional items added through change orders, RFI's, or ASI's. Also, provide control wiring diagram overlaid on Architect floor plans to show actual control wiring routing and controller locations.
- C. Refer to Section 017700 – CLOSEOUT PROCEDURES for additional requirements.

1.24 OPERATION AND MAINTENANCE DATA

- A. General: Refer to Section 017700 – CLOSEOUT PROCEDURES for general requirements for submittal of operations and maintenance manuals, training of personnel and related closeout procedures. The following paragraphs supplement the requirements of Section 017700.
- B. In addition to the information required by Section 017700 for maintenance data, Closeout procedures specific to the Work of this Section include the following:
 - 1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 2. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and user summer and winter operating instructions.
 - 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 4. Servicing instructions and lubrication charts and schedules.
 - 5. Provide start-up reports for all major HVAC systems and equipment, including but not limited to, boilers, chiller, all air handling equipment, ductless cooling unit systems, pumps and fans.
 - 6. Provide DVD recording of operation and maintenance training sessions and include as part of Operation and Maintenance Manual submittal. Provide indexed table of contents for DVD recording.
 - 7. Cooperate with Commissioning agent as required to complete system and equipment start-up reports and testing. Refer to Section 019113 – GENERAL COMMISSIONING REQUIREMENTS and Section 230800 – COMMISSIONING OF HVAC SYSTEMS.
 - 8. ATC Drawings/submittal of As-Built conditions.

1.25 WARRANTIES

- A. The subcontractor shall provide a one year minimum warrantee on all product (unless otherwise stated in the product specification for a specific product) and labor for work under this section. Refer to general conditions for additional warranty requirements. All Warranty periods shall commence upon the date of substantial completion.
- B. Refer to Section General Conditions and Section 017700 - CLOSEOUT PROCEDURES for additional procedures and submittal requirements for warranties.

- C. ATC Controls: In addition to the one year warranty period against component and/or workmanship defects, the 40 hours of training and the 80 hours of additional programming as it relates to the control system and as indicated in section 230000 paragraph 2.30 & 3.32, the ATC contractor shall provide a seasonal site visit to confirm, verify and modify as required the sequence and/or programming of each piece of equipment to ensure the system is functioning as required and per the sequence of operations. The ATC contractor shall provide 16 labor hours per season (four times within a year, total of 64 hours). During each visit they shall, for each piece of equipment confirm operation and functionality, modify and/or repair any control related issues and/or programming and provide training as requested by the owner. This requirement will ensure the equipment/building is operating properly and efficiently as it cycles through each season. These seasonal site visits shall begin the following season after substantial completion of the project is issued. Upon substantial completion the ATC contractor shall issue four dates to the engineer of record and owner. Signatures and time logs will be kept by both parties to ensure these visits occur.

1.26 SUSTAINABLE DESIGN INTENT

- A. Comply with project requirements intended to achieve a minimum score of 50, measured and documented according to LEED Version 4. Project scores will be verified by a third party certifier.
1. Refer to Section 018110– SUSTAINABLE DESIGN REQUIREMENTS – LEED for Schools, for material, procedure, and documentation submittal requirements.
- B. The project HVAC subcontractor shall perform all required work for the LEED credits listed under Section 018113.23 and as outlined in the LEED Reference Guide Version Four:

<u>Indoor Environmental Quality</u>		
Item	Title/Description	HVAC Subcontractor Responsibility
IEQ P 1	Design ventilation systems to ASHRAE Standard 62.1-2004: Ventilation for Acceptable Indoor Air Quality.	Install and Balance systems per Design requirements.
IEQ C 3.1	If the building or a portion of the building is to be occupied during construction, meet or exceed the Recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) <i>IAQ Guideline for Occupied Buildings Under Construction</i> , 1995, chapter 3.	Follow SMACNA Guidelines; coordinate with GC. ATC Contractor shall modify sequences as needed for this credit & return the sequences back to the requirements of the contract documents.
IEQ C 3.2	Construction management – provide ventilation	Provide unit start-up with GC to provide required

<u>Indoor Environmental Quality</u>		
Item	Title/Description	HVAC Subcontractor Responsibility
		flush-out. Provide required filter changes.
IEQ C 3.2	Construction management – post construction IAQ provide building flushout.	Provide flush-out calculation and coordinate unit start-up with GC to provide required flush-out. Provide temporary heating for areas served by air handling units which are not designed to heat 100 percent O.A. (i.e. re-circ RTUs if flushout occurs during winter heating season to maintain minimum 60°F space temp).
IEQ C 5	Install dedicated exhaust for pollutant source control.	Install exhaust air systems as designed.
IEQ C 5	Ensure that permanently installed filtration media have a Minimum Efficiency Reporting Value (MERV) of at least 13.	Provide MERV-13 filters.
IEQ C 7.1	Thermal comfort – ASHRAE 55	Install mechanical systems & control as designed.
IEQ P 3 & C 9	Ensure that all classrooms meet the acoustic standards of ANSI 12.60-2002.	Comply with Acoustical Consultant's report recommendation; install equipment meeting specified sound data. Refer to Vibration isolation specifications for additional requirements.
IEQ C 5	Install premium HVAC filtration.	Provide MERV-13 filters.
IEQ C 3.1 & 3.2	Construction management – post construction IAQ provide building flushout.	Prior to flushout, replace filters with MERV 13 filters and again after flushout

Energy Efficiency		
Item	Title/Description	HVAC Subcontractor Responsibility
EA P 2 & C1	(A, B, or C). Energy Efficiency Standard: Design a school that performs significantly better than schools built to current standard practice by designing 25 percent or more above the ASHRAE 90.1 – 2007 standard using A) the prescriptive criteria established by the New Buildings Institute's main resource guide: <i>Benchmark: Energy Benchmark for High Performance Buildings</i> , B) the prescriptive approach outlined in the ASHRAE standards, or C) the Total Building Approach outlined in the ASHRAE standards.	Provide equipment meeting or exceeding energy efficiency design requirements; submit shop drawings indicating equipment efficiencies.
EA P 1	Provide effective and complete training and documentation on the operation and maintenance of the building systems identified in the commissioning report.	Provide Operating and Maintenance manuals for all HVAC/ATC systems and equipment. Provide owner training and video tape training sessions for all HVAC/ATC systems. Coordinate training with GC.
EA C 1	Demonstrate superior energy performance (25 percent-45 percent reduction).	Provide equipment meeting or exceeding energy efficiency design requirements; submit shop drawings indicating equipment efficiencies.
EA C 5	Install energy management system.	Install ATC/EMS system meeting design requirements and to monitor energy use.

1.27 ENERGY REBATE PROGRAM

- A. This project has been designed to incorporate equipment approved for energy rebate such as boilers, chillers, high efficiency motors, rooftop units, pumps, ductless split cooling units and Combined Heating and Power Modules. Contractor shall review Utility Company requirements prior to submitting shop drawing to ascertain that submittal meets program guidelines. All submitted equipment shall meet utility company rebate program efficiency requirements. Contractor shall furnish equipment submittals, related equipment/system pricing data and all required rebate application information, and forms to utility company.

1.28 HOISTING EQUIPMENT AND MACHINERY

- A. Unless otherwise specified, all hoisting and rigging equipment and machinery required for the proper and expeditious prosecution and progress of the Work of this Section shall be furnished, installed, operated and maintained in safe condition by each sub-contractor, as specified under Section 015000, TEMPORARY FACILITIES AND CONTROLS.

1.29 STAGING AND SCAFFOLDING

- A. Unless otherwise specified, each sub-contractor shall provide all lifts and man-lifts, and furnish, erect and maintain in safe condition, all staging and scaffolding as specified under Section 015000 Temporary Facilities and Controls, as needed for proper execution of the work of this Section. Staging and scaffolding shall be of adequate design, erected and removed by experienced stage builders having all accident prevention devices required by Federal, state and local laws.

1.30 WELDING QUALIFICATIONS

- A. Piping shall be welded in accordance with qualifications procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operations qualified by another employer may be accepted as permitted by ASME B31.1. The Owner's Representative shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Division 01.
- B. When open-flame or spark producing tools such as welding equipment, and the like are required in the process of executing the work, the Construction Manager shall be notified not less than twenty four hours in advance of the time that the work is to begin and the location where work is to be performed. Provide fire protective covering and maintain constant fire watch/fire detail (by the Framingham Fire Department) where work is being performed and until it is completed. This Subcontractor shall be responsible for obtaining required permit and paying all permit fees and Firewatch detail expenses.

1.31 TRADE RESPONSIBILITY FOR INTERCONNECTIONS MATRIX

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
Smoke Detectors (Area type)	26 00 10	26 00 10	26 00 10	23 00 00 (ATC)	26 00 10	
Smoke Detectors (Duct mounted)	26 00 10	23 00 00	26 00 10	23 00 00 (ATC)	26 00 10	
Carbon Monoxide Detectors (Duct mounted)	26 00 10	23 00 00	26 00 10	23 00 00 (ATC)	26 00 10	
Smoke & Fire/Smoke Dampers	23 00 00	23 00 00	N/A	N/A	N/A	
Smoke & Fire/Smoke Damper Actuators	23 00 00	23 00 00	26 00 10 & 23 00 00 (ATC)	23 00 00 (ATC)	26 00 10	2
Fire Dampers	23 00 00	23 00 00	N/A	N/A	N/A	
VAV Box Damper Actuator	23 00 00 (ATC)	Box Mfr	23 00 00 (ATC)	23 00 00 (ATC)	N/A	2
VAV Box DDC Controller	23 00 00 (ATC)	Box Mfr	23 00 00 (ATC)	23 00 00 (ATC)	N/A	2
Hydronic Control Valves	23 00 00 (ATC)	23 00 00	N/A	23 00 00 (ATC)	N/A	1
Hydronic Control Valve Actuator	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	N/A	1
Sheet Metal Damper	23 00 00	23 00 00	N/A	N/A	N/A	1, 6
Sheet Metal Damper Actuators	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	N/A	1, 6
Natural Gas Energy Meters	22 00 00 (ATC)	22 00 00	26 00 10 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Electrical Energy Meters	26 00 10	26 00 10	26 00 10 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Domestic Water Meters	23 00 00 (ATC)	22 00 00	26 00 10 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	3
Airflow Measuring Stations	23 00 00 (ATC)	23 00 00 (ATC)	N/A	23 00 00 (ATC)	N/A	

Device	Furnished By	Installed By	Power Wiring	Control Wiring	Fire Alarm Wiring	Notes
DDC Panels	23 00 00 (ATC)	23 00 00 (ATC)	26 00 10 & 23 00 00 (ATC)	23 00 00 (ATC)	N/A	4, 7
VFDs at RTU & MAU	230000	230000 (RTU MFG.)	26 00 00	230000 (ATC)	N/A	10, 11
VFDs at EFs (except Kitchen EF), Pumps & AHUs	26 00 00	26 00 00	26 00 00	23 00 00 (ATC)	N/A	5, 6, 9
VFDs at EFs at Kitchen Exhaust	Kitchen Equipment Vendor	26 00 00	26 00 00	23 00 00 (ATC)	N/A	
Elevator Hoistway Vent Damper	23 00 00	23 00 00	N/A	N/A	N/A	
Elevator Hoistway Vent Damper Actuator	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	23 00 00 (ATC)	26 00 10	
Emergency Shower/Eye Wash	22 00 00	22 00 00	26 00 10	23 00 00 (ATC)	N/A	
Boiler Breeching	23 00 00	23 00 00	N/A	N/A	N/A	
DHW Breeching	22 00 00	22 00 00	N/A	N/A	N/A	
Kitchen Emergency Gas Valve	22 00 00	22 00 00	26 00 10	26 00 10	26 00 10	
Kitchen Energy Management System	Food Service Contractor	Food Service Contractor	26 00 10	23 00 00 (ATC)	26 00 10	
Rooftop Mechanical Enclosure	230000	230000	26 00 10	230923	26 00 10	5, 6, 7, 8

Notes:

1. Division 23 00 00 and Division 23 00 00 (ATC) Contractors shall fully coordinate all airflow damper and hydronic valves sizes and quantities.
2. Smoke Damper and VAV Box power wiring shall be provided by Division 26 00 10 to junction box locations shown on electrical drawings; Division 23 00 00 (ATC) Contractor shall provide final power wiring from junction box to end device location.
3. Division 26 00 10 Contractor shall provide all line-voltage power wiring required for meters; Division 23 00 00 (ATC) Contractor shall provide all low-voltage power wiring required for meters.
4. Division 26 00 10 shall provide power at main DDC Panel. Division 23 00 00 (ATC) shall provide power to all other DDC Panels.
5. VFDs for HVAC pumps located within rooftop mechanical plant enclosure shall be provided by rooftop mechanical plant and enclosure manufacturer.

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6. Sheetmetal dampers and actuators, required for rooftop mechanical plant (RME) and enclosure shall be provided by RME manufacturer.
 7. DDC panel required for rooftop mechanical plant and enclosure (RME) shall be provided by ATC Contractor
 8. Division 230000 to field install pipe and duct insulation and all mechanical equipment identification. Division 210000 and 220000 to field install all Division 210000 and 220000 trade related piping and equipment insulation and identification.
 9. Division 26 00 10 shall provide VFDs for all EFs and pumps with exception to EFs and/or pumps provided with ECM motors. ECM motors are specified in Division 23 00 00 and provided by Division 23 00 00 coordinate with mechanical schedules and specifications.
 10. Power wiring for RTU, and MAU shall be a single point connector made by the Electrical Contractor (26 00 10). Integral wiring and connections shall be provided by Division 23 00 00.
 11. Division 26 00 10 shall provide dedicated 120V, 20 amp branch circuit for service light and receptacles for all RTU's and MAU. Division 26 00 10 shall provide GFI/WP type receptacles within 20' of all RTU's and MAU and type "J" fixtures with switch in unit vestibules and service areas within units.

PART 2 - PRODUCTS

- 2.1 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)
 - A. Pursuant to Massachusetts General Laws Chapter 141, a Massachusetts Licensed electrician shall install all low voltage wiring required by this section.
 - B. General: The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
 1. All motors for all mechanical equipment shall be NEMA premium efficiency matching the following and all motors associated with variable frequencies drives shall be inverted duty motor with Aegis bearing protection rings:

	HP	RPM	Efficiency
a.	1	1800	85.5 percent
b.	1.5	1800	86.5 percent
c.	2	1800	86.5 percent
d.	3	1800	89.5 percent
e.	5	1800	89.5 percent
f.	7.5	1800	91.0 percent
g.	10	1800	91.7 percent
h.	15	1800	93.0 percent
i.	20	1800	93.0 percent
j.	25	1800	93.6 percent
k.	30	1800	94.1 percent
l.	40	1800	94.1 percent

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- m. 50 1800 94.5 percent
 - 2. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
 - 3. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
 - 4. Temperature Rating: Rated for 40 degrees C. environment with maximum 50 degrees C temperature rise for continuous duty at full load (Class F Insulation). All ratings shall be for inverter duty applications.
 - 5. Starting Capability: Frequency of starts as indicated by automatic control system and not less than five evenly time spaced starts per hour for manually controlled motors.
 - 6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors.
 - 7. Motor Construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B", except "C" where required for high starting torque.
 - 8. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
 - 9. Bearings:
 - a. Ball or roller bearings with inner and outer shaft seals.
 - b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance.
 - c. Designed to resist thrust loading where belt drivers or other drives produce lateral or axial thrust in motor.
 - d. For fractional horsepower, light duty motors, sleeve type bearings are permitted.
 - 10. Enclosure Type:
 - a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
 - b. Guarded drip-proof motors where exposed to contact by employees or building occupants.
 - c. Weather protected Type I for outdoor use, Type II where not housed.
 - 11. Overload Protection: Built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
 - 12. Noise Rating: "Quiet".
 - 13. Efficiency: "Premium Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112, Test Method B.
 - 14. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.
 - 15. Provide AEGIS magnetic bearing protection ring for all inverter rated motors that are controlled by variable speed drives. The bearing protection ring shall channel harmful shaft voltages to ground to protect bearing races from pitting.
- C. Starters, Electrical Devices, And Wiring: (Provided By The HVAC Contractor For Each Packaged Piece Of HVAC Equipment Requiring Such):

1. Motor Starter Characteristics:
 - a. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC proper class and division.
 - b. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.
2. Manual Switches shall have:
 - a. Pilot lights and extra position for multi-speed motors.
 - b. Overload Protection: Melting alloy type thermal overload relays.
3. Magnetic Starters:
 - a. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
 - b. Trip-free thermal overload relays, each phase.
 - c. Interlocks, pneumatic switches and similar devices as required for coordination with control requirements of Division 23 Controls Sections.
 - d. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.
 - e. Externally operated manual reset.
 - f. Under-voltage release or protection.
4. Capacitors:
 - a. Individual unit cells.
 - b. All welded steel housing.
 - c. Each capacitor internally fused.
 - d. Non-flammable synthetic liquid impregnant.
 - e. Craft tissue insulation.
 - f. Aluminum foil electrodes.
 - g. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors one horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.
5. Disconnect Switches:
 - a. Fusible Switches: Fused, each phase; general duty; horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.

- b. Non-fusible Switches: For equipment two horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than two horsepower, switches shall be the same as fusible type.

2.2 VALVES

A. General:

1. Comply with ASME B31.9 for building services piping, and ASME B31.1 for power piping.
2. Valves shall have rising stem, or rising outside screw and yoke stems; except, non-rising stem valves may be used where headroom prevents full extension of rising stems.
3. Pressure and temperature ratings shall be as required to suit system pressures and temperatures.
4. Unless otherwise indicated, provide valves of same size as upstream pipe size. Automatic control valves shall be sized by the ATC Contractor and shall not exceed a three PSI drop.
5. Provide the following special operator features:
 - a. Handwheels fastened to valve stem, for valves other than quarter turn, by brass nut on a square-topped stem.
 - b. Lever handle on quarter-turn valves 6 in. and smaller, except for plug valves. Provide one wrench for every 10 plug valves, and one year's supply of recommended lubricant and sealant.
 - c. Chain-wheel operators for valves 2-1/2 in. and larger installed 72 in. or higher above finished floor elevation. Extend chains to an elevation of 5 ft. - 0 in. above finished floor elevation.
 - d. Gear drive operators on quarter-turn valves 8 in. and larger.
6. Where insulation is indicated or specified, provide extended stems arranged to receive insulation.
7. Bypass and drain connections shall comply with MSS SP-45.
8. End connections shall be as specified in the individual valves specifications.
 - a. Threads: Comply with ANSI B2.1.
 - b. Flanges: Comply with ANSI B16.1 for cast iron ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
9. Solder-Joint: Comply with ANSI B16.18.
10. Caution: Where soldered end connection are used, use solder having a melting point below 840 degrees F. for gate, globe, and check valves; below 421 degrees F. for ball valves.

B. Gate Valves:

- Gate Valves – 2 in. and smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, solid disc, bronze alloy stem with less than 6 percent zinc content, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.

MANUFACTURER	THREADED	
	NRS	RS
Crane:	x	431UB
Jenkins:	x	47CU
Lunkenheimer:	x	3151
Nibco:	T-136	T-134
Stockham:	B-130	B-120
Milwaukee:	41M	1151M

- Gate Valves 2-1/2 in. and larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.

MANUFACTURER	OS&Y RS	NRS
Crane:	465-1/2	461
Jenkins:	651C	326C
Lunkenheimer:	1430	1428
Nibco:	F-617-0	F-619
Stockham:	G-623	G-612
Milwaukee:	F-2885-M	F-2882-M

C. Ball Valves:

- Ball Valves 1 in. and smaller: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure, 2-piece construction, bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for heating hot water service, threaded ends for heating hot water.

MANUFACTURER	THREADED	SOLDER
	ENDS	ENDS
Milwaukee:	BA-100	BA-150
Conbraco (Apollo)	70-100	70-200
Crane:	9302	9322
Jamesbury:	21-1000TT	x
Jenkins:	900A	902A
Lukenheimer:	AQ311	x
Nibco:	T-585	S-585
Watts:	B-6000	B-6001
Stockham:	S-216 BR-R-T	S-216 BR-R-S

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2. Ball Valves 1-1/4 in. to 2 in.: Rated for 150 psi saturated steam pressure, 600 psi WOG pressure; 3-piece construction, bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for heating hot water service, threaded ends for heating hot water.

	THREADED	SOLDER
MANUFACTURER	ENDS	ENDS
Milwaukee:	BA-300	BA-350
Conbraco Apollo):	82-100	82-200
Nibco:	T-595-Y	S-595-Y
Watts:	B-6800	B-6801
Stockham:	S-216 BR-R-T	S-216 BR-R-T

For grooved end connections use Victaulic Style 721.

D. Plug Valves

1. Plug Valves – 2 in. and smaller: 150 psi WOG, bronze body, straightaway pattern, square head, threaded ends.

MANUFACTURER

Rockwell:	214.
Lunkenheimer:	454.
Crane:	250.

2. Plug Valves - 2-1/2 in. and larger: MSS SP-78; 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends.

MANUFACTURER

Rockwell:	305.
Nordstrom:	143.
Serck-Audco:	LSW-133-GG.
Homestead:	612.
Victaulic Series	377

E. Globe Valves:

1. Globe Valves – 2 in. and smaller: MSS Sp-80; Class 150, body and union bonnet of ASTM B 62 cast bronze, threaded ends, brass or replaceable composition disc, bronze alloy stem with less than 6 percent zinc content, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel.

MANUFACTURER

Jenkins:	106-B.
Lunkenheimer:	407.
Nibco:	T-235-Y.
Stockham:	B-22.

2. Globe Valves - 2-1/2 in. and larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing and two-piece backing gland assembly.

MANUFACTURER	STRAIGHT BODY	ANGLE BODY
Milwaukee:	F-2981-M	x
Crane:	351	353
Jenkins:	613C	x
Lunkenheimer:	1123	x
Nibco:	F-718-B	x
Stockham:	G-512	G-515

F. Butterfly Valves:

1. Butterfly Valves - 2-1/2 in. and larger: MSS SP-67; 200 psi, cast iron body conforming to ASTM A 126, Class B. Valves shall have field replaceable EPDM sleeve, with aluminum bronze disc, stainless steel, and EPDM O-ring stem seals. Sizes two through six in. shall have lever operators with locks, and sizes eight through 24 in. shall have gear operators with position indicator. Valves on dead end service or requiring additional body strength shall be lug-wafer type, drilled and tapped.

MANUFACTURER	WAFER	
	LEVER	GEAR
Milwaukee:	x	MW-123-E
Center Line:	x	Series A
Crane:	42	x
Keystone:	100	x
Nibco:	WD-20003	WD-20003
Stockham:	LG-512-BS3E	LG-522-BS3E

MANUFACTURER	LUG	
	LEVER	GEAR
Milwaukee:	x	ML-123-E
Center Line:	x	Series LT
Crane:	44	x
Keystone:	129	x
Nibco:	LD-20003	LD-20005
Stockham:	LG-712-BS3E	LG-722-BS3E

Grooved Ends: Victaulic Series Vic 300 2-12 in. Victaulic series 709 14-24.

G. Check Valves:

1. Swing Check Valves – 2 in. and smaller: MSS SP-80; Class 150, cast bronze body and cap, conforming to ASTM B 62, horizontal swing, with a Teflon disc, and having threaded ends. Valve shall be capable of being repaired while the valve remains in the line.

MANUFACTURER

Milwaukee: 510T
Crane: x
Jenkins: 352C
Lunkenheimer: 230-70
Nibco: T-433-Y
Stockham: B-321

For grooved connections us Victaulic Series 716, 779.

2. Swing Check Valves - 2-1/2 in. and larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Milwaukee:	F-2974-M	x
Crane:	373	375
Jenkins:	624C	477
Lunkenheimer:	1790	x
Nibco:	F-918B	x
Stockham:	G-931	G-940
Victaulic Series	716, 779.	

3. Wafer Check Valves - (Non-Slam): Class 250, cast iron body, replaceable lapped bronze seat, lapped and balanced twin bronze flappers and stainless steel trim. Valve shall be designed to open and close at approximately one foot differential pressure. Twin flappers shall be loaded with a stainless steel torsion spring to minimize flapper drag and assure even non-slam checking action.

MANUFACTURER

Milwaukee: 1400-2C
Center Line: CLC
Metraflex: Chexx
Mission: 12HMP
Stockham: WG970

For grooved connection use Victaulic Series 716 and 779.

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4. Lift Check Valves – 2 in. and smaller: Class 125, cast bronze body and cap conforming to ASTM B 62, horizontal, lift type valve, bronze disc and threaded ends. Valve shall be capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL
Milwaukee:	544
Hammond:	901
Jenkins:	117C
Lunkenheimer:	2142

H. Manual Flow Control Valves – Multi-Turn:

1. Manual Flow Control devices shall be NEXUS Ultra MB Multi-Turn or equal balancing type accurate to at least $\pm 5\%$.
2. MFCV 1½” and smaller shall be forged brass Y-pattern globe style and valves 2” – 2½” shall be a cast brass Y- pattern globe style with integrated ball valve and integral union, (2) pressure/temperature test ports, visual turns indicator, locking handle tag, blowout proof stem with dual FKM o-ring seals, interchangeable union end with FKM o-ring seal, hard chrome plated ball with Teflon™ seats, and rated at 600 PSI WOG, 325 degrees F. Valves shall be available with NPT, SWT, PRESS or PUSH connections. Note: If P/T ports are not closed to the system a secondary shutoff shall be supplied by manufacturer.
3. Valve shall carry a LIFETIME product warranty.
4. MANUFACTURER
Milwaukee
Stockham
Nibco
Or Equal

I. Coil Pak – Manual Flow Control: Contractor shall provide and install manual flow control coil piping packages at all locations as detailed in the construction documents

1. Coil Paks shall be designed for a minimum 600 PSIG WOG working pressure for sizes ½” through 2½” and up to 325 degrees F.
2. Each Coil Pak is to include an UltraMB™ or equal combination manual flow control valve, dual isolation valve, and integral union with (2) pressure & temperature test plugs; UltraY™ combination y-strainer, isolation valve, blow down / drain valve, and union with (1) pressure and temperature test plug; UltraU™ accessory port union with (1) manual air vent and (1) pressure and temperature test plug.
3. Each Coil Pak shall be “Bagged & Tagged” for easy identification and storage.
4. Extended pressure and temperature test plugs, manual air vents and handles shall be available. Extended handles shall not break the vapor barrier when operated.

5. MANUFACTURER

Milwaukee
Stockham
Nibco
Or equal

2.3 METERS AND GAGES

A. Glass Thermometers

1. General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
2. Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, nine in. long.
3. Adjustable Joint: Die cast aluminum, finished to match case, 180 degree adjustment in vertical plane, 360 degree adjustment in horizontal plane, with locking device.
4. Tube and Capillary: Magnifying lens, one percent scale range accuracy, shock mounted.
5. Scale: Satin faced, non-reflective aluminum, permanently etched markings.
6. Stem: Copper-plated steel, or brass, for separable socket, length to suit installation.
7. Range: Conform to the following:
 - a. Hot Water: 30 degrees – 240 degrees F. with five degrees F. scale.
8. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following:
 - a. Ernst Gage Co.
 - b. Marshalltown Instruments, Inc.
 - c. Terice (H.O.) Co.
 - d. Weis Instruments, Inc.
 - e. Or Equal.

B. Thermometer Wells

1. General: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide two in. extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.
2. Manufacturer: Subject to compliance with requirements, provide glass thermometers of one of the following:
 - a. Ernst Gage Co.
 - b. Marshalltown Instruments, Inc.
 - c. Terice (H.O.) Co.
 - d. Weis Instruments, Inc.
 - e. Or Equal.

C. Pressure Gages

1. General: Provide pressure gages of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.
2. Type: General use, one percent accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.
3. Case: Drawn steel or brass, glass lens, 4-1/2 in. diameter.
4. Connector: Brass with 1/4 in. male NPT. Provide protective siphon when used for steam service.
5. Scale: White coated aluminum, with permanently etched markings.
6. Range: Conform to the following:
 - a. Water: 0 - 100 psi.
50 - 300 psi.
7. Manufacturer: Subject to compliance with requirements, provide pressure gages of one of the following:
 - a. Ametek/U.S. Gauge.
 - b. Marsh Instrument Co., Unit of General Signal.
 - c. Marshalltown Instruments, Inc.
 - d. Trerice (H.O.) Co.
 - e. Weiss Instruments, Inc.
 - f. Or Equal.

D. Pressure Gage Cocks

1. General: Provide pressure gage cocks between pressure gages and gage tees on piping systems. Construct gage cock of brass with 1/4 in. female NPT on each end, and "T" handle brass plug.
2. Siphon: 1/4 in. straight coil constructed of brass tubing with 1/4 in. male NPT on each end.
3. Manufacturer: Same as for pressure gages.

E. Annular Element Flow Meters And Fittings

1. General: Provide as indicated, flow metering elements constructed of brass and stainless steel, equipped with readout valves to facilitate connecting of differential pressure meter to flow meter. Equip each readout valve with integral shut-off valve designed to minimize system fluid loss during monitoring process. Provide ball type brass isolation valve. Provide calibrated nameplate with flow meter detailing its flow range through range of differential head pressures. Each element shall be of the bi-directional type having four diametrically opposed sensing ports on both upstream and downstream sides in order to ensure average velocity and static pressure. Elements shall be capable of operating at a maximum temperature of 300 degrees F. and maximum pressure of 250 psig.
2. Manufacturer: Subject to compliance with requirements, provide flow meters of one of the following:
 - a. Preso Industries Corp.
 - b. Meriam Instrument.

- c. Dieterich Standard Corp.
- d. Or Equal.

F. Calibrated Balance Valves

1. General: Provide as indicated, calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Equip each readout valve with integral EPT check valve designed to minimize system fluid loss during monitoring process. Provide calibrated nameplate to indicated degree of closure of precision machined orifice. Construct balancing valve with internal EPT O-ring seals to prevent leakage around rotating element. Provide balance valves with preformed polyurethane insulation suitable for use on heating and cooling systems, and to protect balance valves during shipment.
2. Manufacturer: Subject to compliance with requirements, provide calibrated balance valves of one of the following:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Taco, Inc.
 - c. Armstrong Pumps Inc.
 - d. Tour and Andersson
 - e. Or Equal.

2.4 HANGERS & ATTACHMENTS (Refer to SECTION 230548 for Coordination)

A. Horizontal-Piping Hangers and Supports:

1. General: Except as otherwise indicated, provide factory-fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacture for each piping service. Select size of hangers and supports to exactly fit pip size for bare piping, and to insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
 - a. Adjustable Steel Clevises Hangers: MSS Type 1.
 - b. Steel Pipe Clamps: MSS Type 4.
 - c. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
 - 1) Plate: Unguided type.
 - 2) Plate: Guided type.
 - 3) Plate: Hold-down clamp type.
 - d. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.
 - e. Pipe Stanchion Saddles: MSS Tube 37, including steel pip base support and cast-iron floor flange.
 - f. Adjustable Pipe Saddle Supports: MSS Type 38, including steelpipe base support and cast-iron floor flange.
 - g. Single Pipe Rolls: MSS Type 41.

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- h. Adjustable Roller Hangers: MSS Type 43.
 - i. Pipe Roll Stands: MSS Type 44.
 - j. Pipe Rolls and Plates: MSS Type 45.
 - k. Adjustable Pipe Roll Stands: MSS Type 46.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
- a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or Equal.

B. Wall Mounted Piping Supports:

1. Metal Framing Chanel Strut

- a. Area of Section = 0.555 in² (3.6 cm²)

	Axis 1-1	Axis 2-2
Moment of Inertia (I)	0.185 in ⁴ (7.7 cm ⁴)	0.236 in ⁴ (9.8 cm ⁴)
Section Modulus (S)	0.202 in ³ (3.3 cm ³)	0.290 in ³ (4.8 cm ³)
Radius of Gyration (r)	0.577 in (1.5 cm)	0.651 in (1.7 cm)

Raw steel conforms to the following ASTM specifications:

GAUGE	FINISH	ASTM NO.
12	GR & HG	A1011 SS GR 33
	PG	A653 GR 33
14	GR & HG	A1011 SS GR 33
	PG	A653 GR 33
16	GR & HG	A1011 SS GR 33
	PG	A653 GR 33
19	GR	A1008

GR = Perma-Green® III

PG = Pre-Galvanized Zinc

HG = Hot-Dipped Galvanized

2. Pipe clamps, unless noted, are punch-press made from hot-rolled, pickled and oiled steel plates, strip or coil, and conform to ASTM specifications A1008, A575, A576, A635, or A36. The fitting steel also meets the physical requirements of ASTM A1011 SS GR 33. The pickling of the steel produces a smooth surface free from scale.

C. Vertical-Piping Clamps:

1. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps, complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
 - a. Two-Bolt Riser Clamps: MSS Type 8.
 - b. Four-Bolt Riser Clamps: MSS Type 42.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or Equal.

D. Hanger-Rod Attachments:

1. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-pipe hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
 - a. Steel Turnbuckles: MSS Type 13.
 - b. Swivel Turnbuckles: MSS Type 15.
 - c. Malleable Iron Sockets: MSS Type 16.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or Equal.

E. Building Attachments:

1. General: Except as otherwise indicate, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
 - a. Concrete Inserts: MSS Type 18.
 - b. Top Beam C-Clamp: MSS Type 19.
 - c. Side Beam or Channel Clamps: MSS Type 20.
 - d. Center Beam Clamps: MSS Type 21.
 - e. Welded Beam Attachments: MSS Type 22.
 - f. C-Clamps: MSS Type 23.
 - g. Top Beam Clamps: MSS Type 25.
 - h. Side Beam Clamps: MSS Type 27.
 - i. Steel Beam Clamps W/Eye Nut: MSS Type 28.
 - j. Linked Steel Clamps W/Eye Nut: MSS Type 29.
 - k. Malleable Beam Clamps: MSS Type 30.
 - l. Steel Brackets: One of the following for indicated loading:
 - 1) Light Duty: MSS Type 31.
 - 2) Medium Duty: MSS Type 32.
 - 3) Heavy Duty: MSS Type 33.
 - m. Side Beam Brackets: MSS Type 34.
 - n. Plate Lugs: MSS Type 57.
 - o. Horizontal Travelers: MSS Type 58.
2. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
 - a. Carpenter and Patterson, Inc.
 - b. Corner & Lada Co., Inc.
 - c. Elcen Metal Products Co.
 - d. Fee & Mason Mfg. Co.; Div. Figgie International
 - e. ITT Grinnel Corp.
 - f. Or Equal.

F. Saddles and Shields:

1. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
2. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

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4. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
 - a. Elcen Metal Products Co.
 - b. Pipe Shields, Inc.
 - c. Carpenter Patterson, Inc.
 - d. ITT Grinnel Corp.
 - e. Or Equal.
- G. Miscellaneous Materials:
1. Metal Framing: Provide products complying with NEMA STD ML 1.
 2. Steel Plates, Shapes, and Bars: Provide products complying with ASTM A 36.
 3. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
 4. Heavy Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
 5. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.
- 2.5 MECHANICAL IDENTIFICATION (Refer to SECTION 019113 and 230800 Commissioning for additional contract requirements)
- A. Plastic Pipe Markers:
1. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1
 2. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers, complying with ANSI A13.1
 3. Insulation: Furnish 1 in. thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subjected to fluid temperatures of 125 degrees F (52 degrees C) or greater. Cut length to extend 2 in. beyond each end of plastic pipe marker.
 4. Small Pipes: For external diameters less than 6 in. (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than $\frac{3}{4}$ in. wide; full circle at both ends of pipe marker, tape lapped 1-1/2 in.

- B. Application: Provide pipe labels for the following piping system:
1. Heating hot water supply and return.
 2. Refrigerant liquid and suction and hot gas bypass.
 3. Condensate drain.
 4. Chilled water supply and return.
 5. Make-up Water supply and return.
- C. Valve Tags:
1. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 in. high letters and sequenced valve numbers 1/2 in. high, and with 5/32 in. hole for fastener.
 - a. Provide 1-1/2 in. diameter tags, except as otherwise indicated.
 - b. Provide size and shape as specified or scheduled for each piping system.
 - c. Fill tag engraving with black enamel.
 2. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.
- D. Where valves are located above ACT ceilings, furnish and install valve finder ceiling markers on the ceiling grid. Markers shall be a minimum of 3/4" x 2" standard laminated plastic color-coded markers similar to Marking Services MS-900 with MS-1000 top laminate. Colors shall be different for each trade as determined by the Architect. Coordinate installation of markers with ceiling grid contractor.
- E. Valve Schedule Frames:
1. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.
- F. Plastic Equipment Markers:
1. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:
 - a. Green: Cooling equipment and components.
 - b. Yellow: Heating equipment and components.
 - c. Yellow/Green: Combination cooling and heating equipment and components.
 - d. Blue: Equipment and components that do not meet any of the above criteria.
 2. Nomenclature: Include the following, matching terminology on schedules as closely as possible:
 - a. Equipment label "ID" from schedules.
 - b. Design capacity from schedules.
 3. Size: Provide approximate 2-1/2 in. x 6 in. markers for each piece of equipment.

4. Application: Provide equipment labels for the following equipment:
 - a. Boilers
 - b. Pumps
 - c. Expansion Tanks
 - d. Rooftop Units (RTU)
 - e. Exhaust Fans
 - f. Air Cooled Chillers
 - g. Air Cooled Condensing Units
 - h. Air Separators
 - i. Terminal Heating Units equipped with fans (ie. UH's – place label on inside cover)
 - j. Ductless Cooling Unit Systems (place label on inside cover)
 - k. Induction Units (place label on casing above ceiling)
 - l. Glycol Feeders
 - m. Heat Exchangers
 - n. Variable Air and Constant Air Volume Terminal Boxes

G. Ductwork Labels:

1. Provide painted stencils or standard laminated plastic, color coded labels in accordance with ANSI for the following systems:
 - a. Supply Ductwork
 - b. Return Ductwork
 - c. Exhaust Ductwork
 - d. Hazardous Exhaust
 - e. Outside Air Ductwork
 - f. Grease Ductwork

2.6 MECHANICAL INSULATION

A. Piping Insulation Materials:

1. Glass Wool Piping Insulation:
 - a. Manufacturers:
 - 1) Knauf Insulation; Earthwool 1000° Pipe Insulation with ECOSE Technology
 - 2) Knauf Insulation; Earthwool Redi-Klad 1000° Pipe Insulation with ECOSE Technology

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- 3) Or similar as manufactured by Johns Manville, Manson, or Owens Corning
 - a) UL/ULC Classified per UL 723 or FHC 25/50 per ASTM E 84; EPD Certified by UL Environment; Living Building Challenge – Declare Red List Free for unjacketed Earthwool Pipe and composite Redi-Klad Pipe; meeting ASTM C 547, Type IV (1000° F.) or Type I (850° F.); ASTM C 585; ASTM C 411 and ASTM C 795; Verified to be formaldehyde free by UL Environment.
 - b. Vapor Retarder Jacket: ASJ+/SSL+ conforming to ASTM C 1136 Type I,II, III, IV, &VIII secured with self-sealing longitudinal laps and matching butt strips.
 - c. Redi-Klad Jacket: VentureClad 5-ply weather and abuse resistant with self-sealing lap. Zero permeability per ASTM E 96-05; puncture resistance 35.4 kg (189.3 N) per ASTM D 1000; tear strength 4.3 lb (19.4 N) per ASTM D 624; thickness 14.5 mils (0.0145"); tensile strength 68 lb/inch width [306 N (32 kg)/25 mm]
 2. Flexible Unicellular Piping Insulation: ASTM C 534, Type as required.
 - a. Type I - tubular; Type II - sheet. For use between -40 degrees F and 200 degrees F.
 3. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations.
 4. Encase straight pipe insulation, where exposed in occupied areas, using Redi-Klad Pipe Insulation or cover "standard" insulation with one piece 20-mil thick PVC Jacketing. Fasten and seal as per manufacturer's recommendations.
 5. Encase exterior piping insulation using Redi-Klad Pipe Insulation or cover "standard" insulation with aluminum jacket with weather-proof construction.
 6. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.
 7. Adhesives, Sealants and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- B. Piping Insulation Application and Thickness:
1. Application: Cold Piping (40 Degrees F to Ambient):
 - a. Insulate the following cold HVAC piping systems:
 - 1) HVAC make-up water piping.
 - 2) Chilled water supply and return piping
 - 3) Air conditioner condensate drain piping.
 - 4) Refrigerant liquid and suction piping.
 - b. Insulate HVAC cold water piping systems specified above with the following type and thickness of insulation:
 - 1) Fiberglass: 1-1/2 in. thick for all pipe sizes.
 2. Application: Hot Temp HVAC Piping (to 200 Degrees F)
 - a. Insulate the following hot HVAC piping systems
 - 1) HVAC Heating hot water supply and return piping.

- 2) Hot gas refrigerant piping.
 - b. Insulate each piping system specified above with the following type and thickness of insulation:
 - 1) Fiberglass: 1-1/2 in. thick for pipe sizes up to and including 1 1/4 in, 2 in. thick for all 1 1/2 in. pipe and larger.
 - 2) Flexible Unicellular: (Refrigerant piping only) 1 in. thick.
 3. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish aluminum jacketing installed as recommended by the manufacturer. Insulation thickness shall be increased by one inch versus specified pipe insulation thickness.
- C. Ductwork Insulation Materials:
1. Glass Wool Manufacturers:
 - a. Knauf Insulation
 - b. Or similar as manufactured by CertainTeed, Johns Manville, Manson or Owens Corning
 2. Rigid Glass Wool Ductwork Insulation (R-12): UL/ULC Classified unfaced, ASJ+, ASJ and FSK; FHC 25/50 per ASTM E 84 for PSK only; meeting ASTM C 612, Type IA and IB; rigid. Verified to be formaldehyde free by UL Environment, Living Building Challenge – Declare Red List Free.
 3. Flexible Glass Wool Ductwork Insulation (R-6): UL/ULC Classified; meeting ASTM C 553 Types I, II and III; ASTM C 1136 Type II and ASTM C 1290. UL GREENGUARD Gold Certified; Verified to be formaldehyde free by UL Environment; does not contain polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE; Certified to meet all requirements of EUCEB. Flexible, limited combustible.
 4. Jackets for Ductwork Insulation: ASTM C 1136 Type II, with vapor barrier.
 5. Ductwork Insulation Accessories: Provide staples, bands, wire, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
 6. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.
- D. Ductwork Insulation Application and Thickness:
1. Application: Ventilation and AC System Ductwork:
 - a. Insulate the following ductwork:
 - 1) Outdoor air and make up air ductwork.
 - 2) HVAC supply ductwork between HVAC unit discharge and room terminal outlet.
 - 3) Insulate neck and bells of supply diffusers.
 - 4) HVAC return ductwork between room terminal inlet and HVAC unit inlet.
 - 5) HVAC plenums and unit housing not pre-insulated at factory or lined.

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- 6) Exhaust ductwork between in-line exhaust fan and point of exit in building.
 - 7) Combustion air ductwork associated with boilers.
 - b. Insulate each ductwork system specified above with the following type and thickness of insulation:
 - 1) Rigid Fiberglass: In machine rooms, fan rooms, and mechanical spaces insulate all supply air, return air and outside air ductwork with 3 in. thick rigid (minimum R-12). All exposed supply, return and outdoor air ductwork in occupied areas shall be insulated internally with same thickness and material.
 - 2) Flexible Fiberglass: 2 in. thick (minimum R-6)
 - 3) All outside air and make up air ductwork shall be 3 in. rigid (R-12)
 - 4) All exterior ductwork insulation shall be 3" rigid (minimum R-13) and shall be covered with weather and ultraviolet resistant duct insulation wrap as manufactured by Polyguard Alumaguard All-Weather Cool Wrap, FlexClad Ideal Seal 777, or equal.
 - 5) All Exposed Ductwork, Including Ductwork Located Above The Sloped Ac Ceiling Within The Corridor, Shall Be Insulated With A Matte White Rigid Duct Board Insulation Similar To Johns Manville 800 Series Spin-Glass Or Equal.
2. Equipment Insulation Materials:
- a. Rigid Glass Wool Equipment Insulation (R-9.1): UL/ULC Classified; unfaced, ASJ+, ASJ and FSK; FHC 25/50 for PSK only; meeting ASTM C 612, Type IA and IB : rigid. Verified by UL Environment to be formaldehyde free, Living Building Challenge – Declare Red List Free.
 - b. Flexible Glass Wool Equipment Insulation (R-5): UL/ULC Classified; meeting ASTM C 553 Types I, II and III; ASTM C 1136 Type II and ASTM C 1290. UL GREENGUARD Gold Certified; Verified to be formaldehyde free by UL Environment; does not contain polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE; Certified to meet all requirements of EUCEB. Flexible, limited combustible.
 - c. Flexible Unicellular Equipment Insulation: ASTM C 534, Type as required.
 - 1) TYPE I - TUBULAR.
 - 2) TYPE II - SHEET.
 - d. Jacketing material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
 - e. Equipment Insulation Compounds; Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
 - f. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

- E. Equipment Insulation Application and Thickness:
 - 1. Application: Cold Equipment (Below Space Temperature):
 - a. Insulate the following cold equipment:
 - 1) Drip pan under chilled equipment.
 - 2) Expansion Tank
 - 3) Chilled Water pumps
 - 4) Air Separator
 - b. Insulate each item of equipment specified above with the following type and thickness of insulation:
 - 1) Fiberglass: 2 in. thick for cold surfaces above 35 degrees F and 3 in. thick for surfaces 35 degrees F and lower.
 - 2) Flexible Unicellular: 1.5 in. thick.
 - 2. Application: Hot Equipment
 - a. Insulate the following:
 - 1) Expansion Tank
 - 2) Air Separator
 - 3) Radiant Panels
 - b. Insulate each item of equipment specified above with the following type and thickness of insulation:
 - 1) Fiberglass 2 in. thick.
 - 2) Flexible unicellular 1.0 thick (radiant panels only, coordinate with radiant panel manufacturer).

2.7 GREASE DUCT INSULATION

A. MATERIAL

- 1. Thermal Material: 2192 degrees F rated core blanket, manufactured from patented bio-soluble Superwool chemistry (Calcium Magnesium Silicate).
 - a. Product: FireMaster FastWrap XL or Pyroscat Duct Wrap XL as manufactured by Thermal Ceramics.
 - b. Fully encapsulated thermal material in fiberglass reinforced aluminum/polypropylene scrim (FSP).
 - 1) Encapsulation FSP marked with UL Classification Mark.
 - 2) Encapsulation FSP marked with ICC-ES report number ESR 2213 or ESR 2832.
 - 3) Collars supplied in 6 in. (150 mm) wide by 25 ft.t (7620 mm) long rolls.
- 2. Product Characteristics:
 - a. Thickness: 1-1/2 in. (38 mm).
 - b. Nominal Density: 6 pcf.
 - c. R-Value: 7.35 per layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL when tested in accordance with ASTM C 518 at 75 F.

- d. Flame Spread: <25 when tested in accordance with ASTM E 84.
- e. Smoke Development: <50 when tested in accordance with ASTM E 84.

B. ACCESSORY MATERIALS:

1. Glass Filament Tape: Minimum 3/4 in. (19 mm) wide - used to temporarily secure blanket until permanent attachment using steel banding and/or steel insulation pins.
2. Aluminum Foil Tape: Minimum 3 in. (76 mm) used to seal cut edges.
3. Carbon Steel or Stainless Strapping Material Minimum: 1/2 in. (13 mm) wide and 0.015 in. (.38 mm) thick
4. Steel Insulation Pins: Minimum 12-gauge, length sufficient to penetrate through duct wrap insulation.
5. Insulation Clips: Galvanized steel, minimum 1-1/2 in. (38 mm) round or square.
6. Through Penetration Firestop Sealants:
 - a. Packing Material: Remove encapsulation material from FireMaster FastWrap XL or Pyroscat Duct Wrap XL, use core blanket (white) as penetration packing material.
 - b. Firestop sealants per applicable building code report and/or laboratory design listings.
7. Grease and HVAC Duct Access Doors:
 - a. Thermal Ceramics FastDoor XL Access doors; Supplied in standard door sizes of 6 by10 in. (152 mm by 254 mm), 8 by12 in. (203 mm by 305 mm), 12 by12 in. (305 mm by 305 mm) 12 by16 in. (305 mm by 406 mm), and 20 by20 in. (508 mm by 508 mm).

2.8 HYDRONIC PIPING AND ACCESSORIES

- A. Manufacturer:** Subject to compliance with requirements, provide piping system products from one of the following:
1. Grooved Mechanical Joint Pipe, Fittings and Couplings:
 - a. Victaulic Company of America.
 - b. Anvil Gruvlok
 - c. Grinnell
 - d. Or equal
 2. ProPress Copper Piping system (2" pipe and smaller):
 - a. Viega
 - b. Or equal
 3. Pump Discharge Valves (Triple-Duty Valve):
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Taco, Inc.
 - e. Victaulic (Tri-Service Assembly)

- f. Or equal
- 4. Safety Relief Valves:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Spirax Sarco.
 - d. Watts Regulator Co.
 - e. Or equal
- 5. Pressure Reducing Valves:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Taco, Inc.
 - e. Or equal
- 6. Air Vents:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Armstrong Machine Works.
 - c. Hoffman Specialty ITT; Fluid Handling Div.
 - d. Spirax Sarco.
 - e. Or equal
- 7. Air Separators:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Taco, Inc.
 - e. Or equal
- 8. Diaphragm-Type Compression Tanks:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Or equal
- 9. Pump Suction Diffusers:
 - a. Bell & Gossett ITT; Fluid Handling Div.
 - b. Amtrol, Inc.
 - c. Armstrong Pumps, Inc.
 - d. Taco, Inc.
 - e. Victaulic (style 731-D / W731-D)
 - f. Or equal
- 10. Chemical Feeder:
 - a. Dearborn USA.

- b. Vulcan Laboratories, Subsidiary of Clow Corp.
 - c. York-Shibley, Inc.
 - d. Or equal
11. Basket Strainers:
- a. Crane Co.
 - b. Metraflex Co.
 - c. Spirax Sarco.
 - d. Victaulic Company of America. (732/W732/730/W730)
 - e. Or equal

B. PIPE AND TUBING MATERIALS

- 1. Copper Tubing: ASTM grade B 88, Type L hard drawn temper copper tubing.
- 2. Copper Tubing: ASMT grade B 88, Type K, annealed copper tubing.
- 3. Steel Pipe: ASTM A-53 grade B, Schedule 40, seamless, black steel pipe, beveled ends.
- 4. CPVC Plastic Pipe: ASTM D 2846, Chlorinated Poly (Vinyl Chloride) (CPVC) pipe.

C. FITTINGS

- 1. Cast-Iron Threaded Fittings: ANSI B16.4, Class 125, standard pattern, for threaded joints. Threads shall conform to ANSI B2.1.
- 2. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 150, standard pattern, for threaded joints. Threads shall conform to ANSI B2.1.
- 3. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.
- 4. Grooved Mechanical Fittings: ASTM A 106, or ASTM A 53/A53M, Type F, E or S, Grade B fabricated steel, or ASTM A 234, Grade WPB forged steel fittings with grooves or shoulders designed to accept grooved end couplings.
- 5. Grooved Rigid Mechanical Couplings: Consist of a two- piece ductile iron housing per ASTM A536, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - a. Rigid Couplings:
 - 1) Housings 12" and smaller cast with offsetting angled-pattern bolt pads to provide visual confirmation upon metal-to-metal pad contact with no torque requirement. Victaulic Style 107H and Style 07 or equal. Designs that permit spaces at bolt pads or require a torque per manufacturer's written installation instructions not permitted
 - 2) Housings 14" and larger cast with wedge-shaped groove profile, lead-in chamfer and flat pad design for metal-to-metal pad contact. Victaulic Style W07 or equal.

- b. Flexible Couplings:
 - 1) Use in locations where vibration attenuation and stress relief are required. Victaulic Style 177, 77 or W77 or equal. Three flexible couplings may be used in lieu of each flexible connector for vibration attenuation. Couplings shall be placed in close proximity to the vibrating source in accordance with published guidelines.
 - c. Flange Adapters: Ductile iron housing, flat face, for use with grooved end pipe and fittings, for mating directly with ANSI Class 125, 150, and 300 flanges. Victaulic Style 741, 743 or W741 or equal.
- 6. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
 - 7. CPVC Plastic Fittings: ASTM D 2846, Chlorinated Poly Vinyl Chloride (CPVC) socket-type fittings and solvent for solvent cemented joints.
 - 8. Cast-Iron Threaded Flanges: ANSI B16.1, Class 125; raised ground face, bolt holes spot faced.
 - 9. Cast Bronze Flanges: ANSI B16.24, Class 150; raised ground face, bolt holes spot faced.
 - 10. Steel Flanges and Flanged Fittings: ANSI B16.5, including bolts, nuts, and gaskets of the following material group, end connection and facing:
 - a. Material Group: 1.1.
 - b. End Connections: Butt Welding.
 - c. Facings: Raised face.
 - 11. Solder Filler Metals: ASTM B 32, 50-50, Tin-Lead, for condenser water, chilled water, and make-up water and drain piping.
 - 12. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony, for heating hot water and low pressure steam piping.
 - 13. Brazing Filler Metals: AWS A5.8.
 - 14. Gasket Material: EPDM Thickness, material, and type suitable for fluid to be handled, and design temperatures and pressures.
 - 15. Flexible Connectors: Stainless steel bellows with woven flexible bronze wire reinforcing protective jacket; minimum 150 psig working pressure, maximum 250° F. operating temperature. Connectors shall have flanged, grooved or threaded end connections to match equipment connected; and shall be capable of 3/4" misalignment.
 - a. Three (3) flexible couplings may be used in lieu of each flexible connector for vibration attenuation. Couplings shall be placed in close proximity to the vibrating source in accordance with published guidelines.

D. PIPE SLEEVES AND ESCUTCHEONS

- 1. General: Provide schedule 40 black steel or 18 gage galvanized pipe sleeve large enough to accept pipe along with specified pipe insulation at each point where pipe penetrates a wall or floor. Sleeve shall be large enough to allow for free movement of pipe however minimized to prevent leakage of smoke and fire during a fire emergency. For all piping exposed to view provide a chrome plated escutcheon that will surround insulation where applicable on pipe for a neat finished appearance. Where piping is concealed above ceilings no escutcheons are required.

E. SPECIAL DUTY VALVES

1. General: General duty valves (i.e., gate, check, ball, and butterfly valves) are specified in Division 23 Section "Valves" Special duty valves are specified in this Article by their generic name; refer to the drawings for specific applications of these valves.
2. Pump Discharge Valves (Triple-Duty Valve): 175 PSIG working pressure, 300° F. maximum operating temperature, cast-iron body, bronze disc and seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have flanged connections and straight or angle pattern as indicated. Features shall include non-slam check valve with spring-loaded weighted disc, and calibrated adjustment feature to permit regulation of pump discharge flow and shutoff.
 - a. In grooved installations, Tri-Service Assemblies may be used in lieu of Triple-Duty Valves. Straight pattern, (300-psi) pressure rating, combination shut-off, throttling, and non-slam check service in one unit. Victaulic Vic®-300 MasterSeal™ or equal, butterfly valve assembled with Series 779 Venturi Check valve or equal, with flow measurement capabilities and Victaulic or equal couplings (style to be determined by system requirements) for 2" through 12". Straight pattern, 230-psig pressure rating combination shut-off, throttling, and non-slam check service in one unit. Victaulic AGS-300 or equal butterfly valve assembled with Series W715 or equal check valve and Victaulic or equal couplings for 14" and larger.
3. Pressure Reducing Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment.
4. Safety Relief Valves: 125 psig working pressure and 250° F. maximum operating temperature: designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber. Select valve to suit actual system pressure and BTU capacity.
5. Combined Pressure/Temperature Relief Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory-set at operating pressure and have the capability for field adjustment. Safety relief valve designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber; 125 psig working pressure and 250° F. maximum operating temperature. Select valve to suit actual system pressure and BTU capacity. Provide with fast fill feature for filling hydronic system.

F. HYDRONIC SPECIALTIES:

1. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure, 240° F. operating temperature; and having 1/4" discharge connection and 1/2" inlet connection.
2. Diaphragm-Type Compression Tanks: Size and number as indicated; construct of welded carbon steel for 125 psig working pressure, 375° F. maximum operating temperature. Separate air charge from flexible diaphragm securely sealed into tank. Provide taps for pressure gage and air charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Tank, with taps and supports, shall be constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 01.
3. Pump Suction Diffusers: Cast-iron or ductile iron body, with threaded connections for 2" and smaller, flanged or grooved connections for 2-1/2" and larger; 175 psig working pressure, 300° F. maximum operating temperature for flanged and 300 psig working pressure, 230F for grooved; and complete with the following features:
 - a. Inlet vanes with length 2-1/2 times pump suction diameter or greater.
 - b. Cylinder strainer with 3/16" diameter openings with total free area equal to or greater than 5 times cross-sectional area of pump suction, designed to withstand pressure differential equal to pump shutoff head.
 - c. Disposable fine mesh strainer to fit over cylinder strainer.
 - d. Permanent magnet, located in flow stream, removable for cleaning.
 - e. Adjustable foot support, designed to carry weight of suction piping.
 - f. Blowdown tapping in bottom; gage tapping in side.
4. Chemical Filter Feeder: (Provide one (1) for each piping system). Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Feeder shall have a stainless steel dissolving basket that fully supports the filter bag. The filter bag shall be the 5-micron type with ring top and handle. The feeder shall have only a threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel. The filter feeder shall be similar to Neptune Model FTF-5DB.
 - a. Capacity: 5 gal. (19 L).
 - b. Working Pressure: 125 psig (860 kPa)
5. Y-Pattern Strainers: Cast-iron body (ASTM A 126, Class B), flanged ends for 2-1/2" and larger, threaded connections for 2" and smaller, bolted cover, perforated Type 304 stainless steel basket, bottom drain connections; 125 psig working pressure.
6. Basket Strainers: High tensile cast-iron body (ASTM A 126, Class B), flanged end connections, bolted cover, perforated Type 304 stainless steel basket, bottom drain connections; 125 psig working pressure.

7. Grooved-End Strainers:
 - a. Y-Pattern: Ductile iron body ASTM A536, grooved ends for 2" and larger, coupled cover, perforated Type 304 stainless steel basket, bottom drain, 300 psig working pressure.
 - b. T-Pattern: Ductile iron body ASTM A536, grooved ends for 2" and larger, coupled or T-bolt hinged cover, perforated 304 stainless steel basket, bottom drain, up to 750 psig working pressure.
8. Grooved-End Expansion for Steel Piping 2" and larger (Water Service):
 - a. 2" Through 6": Packless, gasketed, slip-type expansion joint with grooved end telescoping body for installation with Victaulic Style 107 or 07 rigid couplings. Provides axial end movement to 3", designed for water services up to 230°F and working pressure to 350 psi. Victaulic Style 150 Mover®.
 - b. 2" Through 24": Combination of short nipples and Victaulic Style 177 or 77 flexible couplings joined in tandem for increased expansion. Joint movement and expansion capabilities dependent on number of couplings/nipples used in the joint. Pressure rating dependent on size and style of flexible couplings used. Victaulic Style 155.
 - c. Expansion Loops: Pipe bends and loops in grooved piping systems shall consist of (8) Victaulic Style 177, 77 or W77 flexible couplings, (4) Victaulic 90° elbows, and (3) grooved end pipe spools provided in water systems to +250°F in accordance with the latest Victaulic recommendations for expansion compensation. Rigid couplings shall not be used on loop corners.
 - d. Expansion Joints: Provide pipe expansion joints at all building expansion joints. Utilize a seismic expansion fitting similar to Metra-Flex, Metra Loop Grooved ends or equal. The expansion fitting shall provide absorption in the lateral offset and angular movement.
9. AIR and DIRT SEPARATORS - Air and dirt removal device shall be constructed of steel. It shall be designed, fabricated and stamped per ASME Section VIII Division 1 with a maximum working pressure of 125 psi at 270°F. Manufacturer shall be holder of ASME U stamp. Manufacturer to have optional 250 psi and 150 psi ASME units available. Units up to three 3-inch in size shall be provided with threaded connections as standard. Units four 4-inch and larger shall be provided with flanged system connections as standard. Inlet and outlet connections to be inline with piping system. Both inlet and outlet to be in the same horizontal and vertical planes. Each air and dirt removal device shall be equipped with a brass conical shaped air venting chamber designed to minimize system fluid from fouling the venting assembly. The air vent shall be able to be closed to allow flushing and purging of dirt via side port without dirt passing through vent on initial system fill. A brass flushing cock shall be located on the side of each separator to facilitate system fast-fill and removal of the floating impurities from the air system interface within the separator. A blow down valve shall be provided by the unit manufacturer on the bottom of each unit to allow blow down and cleaning. On units 2 ½" and smaller the valve and all of its fittings shall be 1". On units three 3" and larger the valve and all openings shall be 2".

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10. Glycol/Make-up Pump - Provide a packaged automatic glycol solution make up unit consisting of a base, polyethylene reservoir with removable lid and visible solution level scale in gallons, y-stainers, isolation valves, fill pump with a minimum capacity of 5 gpm @ 100 psi discharge, open drip proof motor, pump isolation, check and balancing valves, discharge pressure gauge, motor contactor, pressure control and necessary interconnecting piping. Pump shall be a bronze gear driven design and shall have a standard 120 volt power electrical cord and all necessary controllers and safeties. The unit shall provide alarm outputs for BMS connection via Bacnet.
 11. Flexible Expansion Loop (seismic and thermal expansion applications):
 - a. All equipment, either rigidly mounted or mounted on vibration isolators, shall be attached to the piping system using flexible loops designed for seismic movement. Flexible loops shall be capable of movement in the X, Y, and Z planes and must completely isolate the equipment from the piping.
 - b. All piping passing through building seismic joints shall contain a flexible expansion loop designed for seismic movement. Flexible loops shall be located at, or near the building seismic joint. A vertical support hanger, located within 4 pipe diameters, shall be installed on each side of the flexible loop. Each hanger to be transversely and longitudinally braced per local codes. Seismic bracing shall not pass through building seismic joint and shall not connect or tie together different sides or parts of building structure. Flexible loops shall be capable of move in the X, Y, and Z planes.
 - c. Flexible loops attached to fuel gas lines, shall be specifically manufactured for fuel gas applications and certified by the American Gas Association. Flexible loops connected to medical gas piping shall be specifically manufactured for medical gas and installed by a certified installer. Unless specified otherwise by system design engineer or governing codes, all flexible loop connections to medical gas piping shall be cleaned, installed, inspected, and tested in accordance with current NFPA-99 standards.
 - d. Flexible expansion/seismic loops shall consist of two flexible sections of hose and braid, two 90 elbows, and a 180 return assembled in such a way that the piping does not change direction, but maintains its course along a single axis. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180 return, and a drain/air release plug. Flexible loops shall impart no thrust loads to system support anchors or building structure. Flexible loops may be installed to accommodate both thermal and seismic motion. For steam service, loops must be installed with flexible legs horizontal to prevent condensate buildup. Materials of construction and end fitting type shall be consistent with pipe material and equipment/ pipe connection fittings. Movement capabilities and location, relative to seismic separation, shall be determined manufacturers recommendations.
 - e. Flexible expansion/seismic loops to be Metraloop(r) or approved equal

G. Chilled Water Buffer Tank

1. Designed and constructed per ASME Code Section VIII, Division 1.
2. Construction: Carbon Steel with exterior red oxide primer finish.

3. Maximum Design Pressure and Temperature: 125 psi @ 375°F.
4. Flanged inlet and outlet System Connections (refer to plans for pipe sizes).
5. Registered with the National Board of Pressure Vessel Manufacturers.
6. Buffer tanks shall be factory insulated with 1 in cellular foam with vapor barrier insulation rated in accordance with NFPA 90a Fire/smoke ratings.
7. Manufacturers:
 - a. Cemline
 - b. Amtrak
 - c. Wessels
 - d. Or equal

2.9 REFRIGERANT PIPING

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.5 Code for refrigeration piping where applicable, base pressure rating on refrigerant piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in refrigerant piping systems. Where more than one type of materials and products are indicated, selection is Installer's option.
- B. Material: Provide pipes and pipe fittings in accordance with the following listing:
 1. Tube Size 4-1/8 in. and smaller: Copper tube; Type ACR, hard-drawn temper; wrought-copper, solder-joint fittings; brazed joints.
- C. Soldered Joints: Solder joints using silver-lead solder, ASTM B32, Grade 96 TS.
- D. Brazed Joints: Braze joints using American Welding Society (AWS) classification BCUO-4 for brazing filler metal.
- E. Piping Specialties: Provide piping specialties complying with Division 23 "Hydronic Piping" in accordance with the following listing:
 1. Pipe escutcheons.
 2. Drip pans.
 3. Sleeves.
 4. Sleeve seals.
- F. Refrigerant Valves: Special valves required for refrigerant piping include the following types.
 1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 degrees F (149 degrees C) temperature rating, 500 PSI working pressure.
 2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided piston and stainless steel spring, 250 degrees F (121 degrees C) temperature rating, 500 PSI working pressure.

3. Manufacturer: Subject to compliance with requirements, provide globe and check valves of one of the following:
 - a. Henry Valve CO.
 - b. Parker Hannifin Corp.; Refrigeration & Air Cond. Div.
 - c. Sporlan Valve Co.
 - d. Or Equal
 4. 2-Way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL-listed, ½ in. conduit adapter, 250 degrees F (121 degrees C) temperature rating, 400 PSI working pressure.
 5. Manufacturer: Subject to compliance with requirements, provide solenoid valves of one of the following:
 - a. Alco Controls Div.; Emerson Electric Co.
 - b. Automatic Switch Co.
 - c. Sporland Valve CO.
 - d. Or Equal
 6. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL-listed, 350 PSI working pressure.
 7. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL-listed, 200 degrees F (93 degrees C) temperature rating, 500 PSI working pressure.
 8. Refrigerant Filter-Driers: Steel shell, ceramic fired desiccant core, solder connections, UL-listed, 500 PSI working pressure.
 9. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron coverplate with steel cap screws, replaceable filter-drier core, 500 PSI working pressure.
 10. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
 11. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL-listed.
 12. Manufacturer: Subject to compliance with requirements, provide refrigeration accessories of one of the following:
 - a. Alco Controls Div.; Emerson Electric CO.
 - b. Henry Valve CO.
 - c. Parker-Hannifin Corp.; Refrigeration & Air Conditioning Div.
 - d. Sporlan Valve Co.
 - e. Or Equal.
- G. Basic Vibration Control: Provide vibration control products as required in accordance with the following listing:
1. Isolation hangers.
 2. Riser isolators.

3. Riser support isolators.
4. Flexible pipe connectors.

2.10 HIGH EFFICIENCY, GAS-FIRED CONDENSING BOILERS (Refer to SECTION 019113 and 230800 Commissioning for additional contract requirements)

A. Manufacturers

1. This specification is based on the Array Series boilers as manufactured by Riello International Inc. Subject to compliance of specification requirements herewithin, boilers shall be as manufactured by
 - a. Riello
 - b. Aerco
 - c. Viessmann
 - d. Buderus
 - e. Or equal

B. Related Documents

1. Drawings and general provisions of the Contract apply to this Section, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

C. Summary

1. This Section includes packaged, factory-fabricated and -assembled, gas-fired, stainless steel condensing boilers, trim, and accessories for generating hot water.
2. Provide two boilers with similar dimension capacity and efficiency indicated on drawings and as specified here within.

D. SUBMITTALS

1. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
2. Shop Drawings: For boilers, boiler trim, and accessories. Include plans, elevations, sections, details, and attachments to other work.
3. Source quality-control test reports.
4. Field quality-control test reports.
5. Operation and maintenance data.
6. Warranty: Special warranty specified in this Section.
7. Other Informational Submittals: Startup service reports specific to burner type as provided by manufacturer.

E. Quality Assurance

1. Manufacturer Qualifications: Provides products manufactured in ASME-certified facilities.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

3. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
4. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
5. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
6. AHRI Compliance: Boilers shall be tested and rated according to AHRI "Rating Procedure for Heating Boilers" and "Testing Standard for Commercial Boilers," with AHRI emblem on a nameplate affixed to boiler.

F. Warranty

1. Warranty Period for Water-Tube Condensing Boilers:
 - a. Leakage and Materials: 10 years from date of Substantial Completion.
 - b. Heat Exchanger Damaged by Thermal Stress and Corrosion: Non-prorated for 10 years from date of Substantial Completion.

G. Manufacturer Units

1. Description: Factory-fabricated, assembled, and pressure tested, water-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; water supply, and condensate drain connections. Each boiler shall be assembled with required wiring and piping as a self-contained unit.
2. Heat Exchanger: Plasma welded 316L dual tube stainless steel heat exchanger and burner tube with high quality condensing heating surfaces. Each watertube shall be at least 7/8" ID. Stainless steel heat exchangers shall be inspected and tested to ASME Section IV requirements and shall bear the ASME section IV seal of approval. Only boilers employing nonferrous materials on all flue gas passes will be considered.
3. "Near condensing" copper fin designs, cast iron, cast aluminum, or secondary condensing exchangers will not be considered.
4. Pressure Vessel: Carbon steel with welded heads and tube connections, counter-flow design with low- and high-temperature returns. The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall contain a volume of water no less than:

Model	Water Volume in Gallons (Liters)
Scheduled	20.0 (75)

5. Burner:
 - a. Natural Gas, premixed burner.
 - b. The burner shall operate with a 5:1 turn down on each module;

6. Blower: Centrifugal fan to operate during each burner firing sequence and to pre-purge and post-purge the combustion chamber.
 - a. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 1) Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
7. Gas Train: Each boiler shall be supplied with multiple gas valves designed with negative pressure regulation and each boiler module be capable of the minimum 5:1 turndown ratios.
8. Hydraulic Manifold: The Boiler(s) hydraulic manifold piping (water, gas and exhaust/ air) shall be factory installed and self-contained within the Boiler(s) outer cabinet.
9. The boiler shall have a minimum of 86 sqft/1000 MBH of effective fireside heating surface.
10. Ignition: Pilot ignition with 100 percent main-valve shutoff with electronic flame supervision.
11. High Altitude: Boiler shall operate at altitudes up to 2,000 feet above sea level without additional parts or adjustments.
12. Casing:
 - a. Jacket: Sheet metal, with snap-in or interlocking closures.
 - b. Finish: Electrostatic powder-coated protective finish.
 - c. Insulation: Minimum 10mm thick, glass fiber insulation surrounding the heat exchanger.
 - d. Combustion Chamber and Other Flue Passage Access: Full-sized front access
 - e. Access: Side panels easily removed.
13. Design Values and Capacities: Refer to Schedules

H. Trim

1. Include devices sized to comply with ANSI B31.9, "Building Services Piping."
2. Boiler(s) shall be equipped with a multi-speed circulator pump on each module.
3. Aquastat Controllers: Operating, firing rate, and high limit.
4. Safety Relief Valve: ASME rated.
5. Low Water Cut-off: Manual reset whenever boiler water level falls below safe level.
6. Pressure and Temperature Gage: Combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
7. Drain Valve: Minimum NPS 3/4 hose-end gate valve.
8. Boiler and Boiler Breeching Condensate Neutralization System: Provide boiler condensate neutralization system per Specification Section 2.12.

I. Controls

1. Boiler(s) shall be equipped with an integrated 7" color touch-screen controller that shall monitor and control all combustion process functions, control of the boiler water temperature to a value required by the connected components and shall display current water temperatures or fault conditions with changes in operation status.
2. The boiler shall have multiple heating parameters designed for the most common applications with options including:
 - 0 – Heating demand (end switch / Thermostat)
 - 1 – Weather compensations with heating demand
 - 2 – Weather compensation with full outdoor temperature reset
 - 3 – Permanent heat demand
 - 4 – Analog input of setpoint
 - 5 – Analog input of Modulation Rate
3. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections. ATC Controls are specified in Division 230000, and HVAC Control drawings.
4. Boilers shall be provided with BACNet-IP compatible controller capable of integrating into Building Energy Management System.

J. Source Quality Control

1. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

2.11 AIR INTAKE AND EXHAUST BREECHING, CHIMNEYS AND STACKS

- A. The air intake and exhaust vents shall be of the double-wall, factory-built type for use on condensing appliances or pressurized venting systems serving Category II, III or IV appliances or as specified by the equipment manufacturer.
- B. Maximum temperature shall not exceed 550°F.
- C. Vent shall be listed for an internal static pressure of 6 in. w.g. and tested to 15 in. w.g.
- D. Vent shall be constructed with an inner and outer wall, with a 1 in. annular insulating air space.
 1. The inner wall (vent) shall be constructed of AL29-4C superferritic stainless steel, .015 thickness for 4 in.-12 in. diameters and .024 thickness for 14 in.-24 in. diameters.
 2. The outer wall (casing) shall be constructed of type 430 stainless steel, .018 thickness for 4 in.-12 in. diameters and .024 thickness for 14 in.-24 in. diameters.
 3. Inner and outer walls shall be connected by means of spacer clips that maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.
 4. Vent shall be listed for zero clearance to combustibles.

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- E. All parts exposed to the weather shall be stainless steel.
 - F. All supports, roof or wall penetrations, terminations, appliance connectors and drain fittings, required to install the vent system shall be included.
 - G. Roof penetration pieces shall be UL listed and provided by the vent manufacturer.
 - H. All inner vent connections shall be secured by means of profiled connector bands with gear clamp tighteners. Joints shall be sealed with waterproof sealant. Where exposed to weather, the outer closure band shall be sealed to prevent rainwater from entering the space between inner and outer walls.
 - I. Vent shall terminate in accordance with installation instructions and local codes.
 - J. Provide complete breeching sizing and pressure loss calculations and fully coordinate final breeching design and routing with boiler manufacturer and HVAC Contractor.
 - K. Manufacturers: Subject to compliance with requirements, provide all steel, insulated, positive pressure double wall vents of one of the following:
 - 1. Metal-Fab, Corr/Guard Model CG
 - 2. Selkirk Heat-Fab Saf-T Vent CI
 - 3. Schebler eVENTplus
 - 4. or equal

2.12 CONDENSATE NEUTRALIZING TUBES

- A. Contractor shall furnish and install condensate neutralizing tubes for new boiler's condensate drains and flue pipe condensate drains.
- B. Neutralizer tubes shall be as manufactured by JJM Boiler Works, or approved equal, and sized according to input rating of each piece of equipment.
- C. The boiler and flue condensate drains shall not be combined, Provide separate neutralizing tubes for boiler and flue condensates. All piping shall be per manufacturer's piping diagrams and directions. Secure neutralizing tubes and associated drain piping to the floor.

2.13 PUMPS (P) (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer.
- B. Frame-Mounted End Suction Pumps:
 - 1. General: Provide frame-mounted end suction pumps where indicated, and of capacities and having characteristics as scheduled.
 - 2. Type: Horizontal mount, single stage, vertical split case, flexible coupling, base mounted, designed for 175 psi working pressure.

3. Casing: Cast iron, 125 psi ANSI flanges, tappings for gage and drain connections.
4. Shaft: Steel with replaceable shaft sleeve.
5. Bearing: Regreasable ball bearings.
6. Seal: Mechanical, with carbon seal ring and ceramic seat.
7. Motor: Open, dripproof, regreasable ball bearings under motor: Provide AEGIS magnetic bearing protection ring for all inverter rated motors that are controlled by variable speed drives. The bearing protection ring shall channel harmful shaft voltages to ground to protect bearing races from pitting.
8. Impeller: Enclosed type, hydraulically and dynamically balanced keyed to shaft and secured with locking screw.
9. Baseplate: Structural steel with welded cross members, and open grouting area.
10. Coupling: Flexible, capable of absorbing torsional vibration, equipped with coupling guard.
11. Manufacturer: Subject to compliance with requirements, provide frame-mounted end suction pumps of one of the following:
 - a. Bell & Gosset ITT; Fluid Handling Div.
 - b. Taco
 - c. Armstrong Pumps, Inc.
 - d. Or Equal.

C. Inline Pumps:

1. General: Provide single stage, canned-rotor type, in-line pumps where indicated and of capacities and having characteristics as scheduled.
2. Casing shall be constructed of EN-GJL-250 or ASTM-A 48 class 35 cast iron. The pump casing / volute shall be rated for 175psi working pressure for all jobs. The pump flanges shall be matched to suit the working pressure of the piping components on the job, with ANSI class 125 flanges. All casings shall be flanged connections.
3. Impeller: The impeller and shaft shall be class 304 stainless steel.
4. Bearings: The pump and motor form an integral unit without a mechanical seal. The bearings are lubricated by the pumped liquid. No petroleum lubricated bearings will be accepted.
5. Electronics: The pumps shall be able to operate as single or parallel variable speed pumps, where the speed is regulated by an on-board electronic device. The onboard electronics shall allow these pumps to run in parallel, standby or alternating modes.
6. Set-up: The commissioning and set up of the pump shall be accessed through a web interface (data exchange) and use html 1.1 web language. The pump shall provide a port for a RJ-45 cable connection.
7. Pressure control: The electronics shall provide constant pressure control (δp -c), variable differential pressure control (δp -v) as the factory default, proportional pressure control, constant curve duty (uncontrolled pump), rpm regulation and power limitation control.

8. Inputs/outputs: The pump electronics shall come standard with 2 external digital inputs and 1 external digital output to be available for additional mechanical room control. The integrated pump controller shall be provided with BMS communication (BacNet) for pump control and monitoring.
9. Enclosure: The wiring / electronics enclosure shall be class 2, ip44.
10. Code compliance: Pumps should meet UL 778, 1004-1, 508C, CAN/CSA C22.2 #108, #100, #107.1, EMC (89/366 EEC): EN 61000, LVD (73/23/EC): EN 60335-1, EN 60335-2-51, and Machine Safety (98/37/EC): EN ISO 12100.
11. Electronic protection: the pumps shall be electronically protected, be rated for continuous duty and have a built-in startup circuit. The pump electronics shall provide overcurrent, line surge and current limit protection, thermal monitoring, heat sink status and over temperature protection.
12. Internet link: The pump shall be capable of being monitored 24/7 via integrated internet link.
13. Ecm motor: The pump must be driven by an electrically commutated electrical motor (ECM) with permanent magnet rotor. The rotor magnets shall be time stable, non-toxic ceramic magnets (SR-FE). The electrically commuted electrical motor shall be driven by a frequency converter with an integrated PFC filter.
14. Manufacturer: subject to compliance with requirements. Provide in-line ecm pump of one of the following:
 - a. Bell & Gossett
 - b. Taco
 - c. Armstrong
 - d. Or equal
15. All pumps located outdoors (P-5&6) shall be provided with all necessary seals, coatings, enclosures, casings, etc. to allow complete functionality outdoors and be weather resistant.

2.14 AIR COOLED CHILLER

A. SUMMARY

1. This Section includes design, performance criteria, refrigerants, controls, and installation requirements for air cooled centrifugal chillers.

B. REFERENCES

1. Compliance is with the following codes and standards:
 - a. ARI 550/590 NEC
 - b. ANSI/ASHRAE 15
 - c. ASME Section VIII
 - d. ETL Listed
 - e. ANSI UL 1995
 - f. CSA C22.2 No. 236 (Canada)
 - g. OSHA as adopted by the State

C. SUBMITTALS

1. Submittals shall include the following:
 - a. Dimensioned plan and elevation drawings, including required service clearances and location of all field piping and electrical connections.
 - b. Electrical and water quality requirements during operation, standby and shutdown.
 - c. Control system diagram showing points for field interface and connection to external BMS systems. Drawings shall show field and factory wiring.
 - d. Installation and Operation Manuals.
 - e. Manufacturers certified performance data as per AHRI at full load and IPLV or NPLV.

D. QUALITY ASSURANCE

1. Regulatory Requirements: Compliance with the standards in Section 1.2.

E. DELIVERY AND HANDLING

1. Chillers shall be delivered to the job site completely assembled (unless otherwise specified).
2. Compliance shall be with the manufacturer's instructions for transportation and rigging.

F. WARRANTY and MAINTENANCE

1. The chiller manufacturer's warranty shall be for a period of one year from date of substantial completion.
2. The warranty shall include parts and labor costs for the repair or replacement of parts found to be defective in material or workmanship.
3. Maintenance of the chiller equipment while under warranty, is mandatory and shall be the responsibility of the purchaser, unless supplied by the manufacturer.
4. Provide the following extended warranty from chiller manufacturer:
 - a. Additional 1 year Extended chiller parts and labor warranty.
 - b. 2-5-year compressor parts and labor.

G. ACCEPTABLE MANUFACTURERS

1. Smardt Inc.
2. MultiStack
3. ArticChill
4. Approved Equal. Note approved equal does not automatically imply the alternate product matches this specification, functionality or delivered quality. Chiller weight and dimensional footprint shall be similar to the basis of design unit.

H. PRODUCT DESCRIPTION

1. Provide and install as shown on the plans, a factory assembled air-cooled packaged chiller.

2. Each unit shall include one or more Turbocor oil-free magnetic bearing and variable-speed centrifugal compressors. Integrated variable frequency drive shall operate with inlet guide vanes to optimize part load efficiency. Chillers shall operate with HCF-134a refrigerant - not subject to phase-out by the Montreal Protocol and the U.S. EPA clean air act.
3. The compressor, evaporator, condenser, and expansion valve shall be configured to operate as a single refrigerant circuit unless otherwise specified. The chiller unit compressors shall be designed for mechanical and electrical isolation to facilitate service and removal. The basis of design unit shall consist of 4 compressors and refrigerant circuits.

I. DESIGN REQUIREMENTS

1. Unit shall consist of a minimum of four (4) magnetic bearing oil-free centrifugal compressors with integrated variable frequency drive, refrigerant flooded evaporator, air cooled condenser, and operating controls with equipment protection.
2. Performance: Refer to schedule for specific operating conditions. The chiller shall be capable of stable operation down to 15 percent capacity. All these ratings are measured at standard AHRI entering condenser water temperatures and without utilizing hot gas bypass.
3. Acoustics: Sound pressure for the unit shall not exceed 83 dBA, measured at 1 meter (3.28 ft.). Sound data shall be measured according to AHRI Standard 370.
4. Chiller shall be equipped for single-point power connection.

J. CHILLER COMPONENTS

1. Compressors:
 - a. Compressors shall be of semi-hermetic centrifugal design and operate oil-free with two-stages of compression, magnetic bearings, movable inlet guide vanes and integrated variable frequency drive system.
 - b. Automatically positioned and controlled inlet guide vanes shall operate with compressor speed controls.
 - c. The compressor shall be capable of coming to a controlled stop in the event of a power failure. The unit shall be capable of initializing an automatic restart in the case of power failure.
 - d. Each compressor shall have integrated microprocessor control capable of capacity and safety control.
 - e. Each compressor shall be installed with individual suction, discharge and motor cooling refrigerant line isolation valves. Chillers without discharge line isolation valves that rely on non-return valves in the discharge line for compressor removal, shall not be accepted.
 - f. Each compressor shall have an individual disconnect switch. On chillers that are provided with more than one compressor, each compressor shall have mechanical and electrical isolation to allow the chiller to operate when a compressor is removed.
 - g. Optional features from chiller manufacturer:
 - 1) EMI filters installed for each compressor.

2. Evaporator:

- a. Evaporator shall be shell-and-tube type and shall be designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII Code Case 1518-5. Refrigerant shall be in the shell and water inside the tubes. The water sides shall be designed for a minimum of 150 psig or as specified. Vents and drains shall be provided. The refrigerant side shall bear the ASME Code stamp. Vessels shall pass a test pressure of 1.1 times the working pressure but not less than 689 kPa (100 psig). Provide intermediate tube supports spaced to enable equal liquid and gas flow across multiple compressor suction ports. The evaporator water connections shall also be equipped with right-hand or left-hand connection, interchangeable.
- b. A perforated plate designed for vapor disengagement shall be installed inside the evaporator above the tubing, to ensure effective liquid droplet removal, to prevent liquid damage to compressors, and to equalize suction pressure across evaporators with multiple compressors.
- c. Tubes shall be individually replaceable and have internally and externally enhanced surfaces designed for refrigeration duty. Tubes shall have smooth full tube wall landings at the tube-sheet ends and at intermediate tube supports. Tubes shall be mechanically roller expanded into steel tube sheets containing a minimum of three concentric grooves.
- d. Minimum evaporator exiting water temperature shall be 3.3°C (38°F). Minimum entering condenser air temperature shall be 0°C (32°F). Minimum inlet condenser air to outlet chilled water difference shall be - 11.1°C (12°F).
- e. The evaporator, including chilled water boxes, compressor suction line, compressor end bell, and all other components, subject to condensing moisture, shall be insulated with UL recognized ¾ inch closed cell insulation. All joints and seams shall be sealed to form a vapor barrier.
- f. Provide the following features from chiller manufacturer:
 - 1) Marine water boxes.
 - 2) Epoxy-coating of inside surfaces of water boxes and tube sheets.
 - 3) Double insulation, 1½ inch, on evaporator, water boxes, suction piping.

3. Air-Cooled Condenser:

- a. Air cooled packaged chillers and controls shall be capable of reliable operation between 0 deg. C (32 deg. F) and 40.6 deg. C (105 deg. F) ambient air temperature.
- b. Air-cooled condensers shall utilize mill-coated hydrophilic-blue aluminum fins with refrigeration duty copper tubes mechanically expanded into fin collars. Condenser coils shall be arranged in a W-configuration to reduce equipment footprint.
- c. Condenser coils and fans shall be arranged such that one fan operates with one coil section so that the failure of a fan will not affect the CFM across any coil beyond that fan. The standard coating shall meet ASTM B117 2000hr salt spray test.

- d. The condenser shall be equipped with an oversized liquid line and mechanical float to ensure liquid sub-cooling necessary for effective cooling of the compressor.
 - e. The condenser shall be equipped with packaged fixed or variable speed fans capable of delivering specified CFM of air according to ARI standard operating conditions. The fan motors shall be high efficiency, direct drive, 3-phase, insulation class "F", current protected, Totally Enclosed Air Over (TEAO), double sealed and with permanently lubricated ball bearings.
 - f. The fans shall be low sound. They shall be balanced dynamically and statically and direct drive. Also, the blades shall be corrosion resistant designed for low noise, full airfoil cross section, providing vertical air discharge from extended orifices. The guards shall be constructed of heavy duty 14 gauge steel and painted.
 - g. Include the following features from chiller manufacturer:
 - 1) The coating system for HVAC coil corrosion resistance provides a lifetime protection against micro-organism contamination that causes unwanted odors, and shall pass a 10,000 hour salt spray test. Next to anti-corrosion protection and energy conservation of the total system, the coating shall prevent adhesion of dirt and growth of micro-organisms, and shall also prevent chemical, galvanic, and microbial corrosion.
 - 2) Low ambient kit shall allow operation down to 9.4 deg. C (15 deg. F).
4. Refrigeration Components
- Liquid Level Controls:
- a. Control of refrigerant flow shall utilize a single or multiple 6,000 step electronic expansion valve (EXV), to operate within the full range from full load to the lowest loading capacity for the chiller. Fixed orifice metering devices or float controls using hot gas bypass are not acceptable. The EXV liquid line shall have a sight glass with moisture indicator and temperature sensor connected to the control system for validation of sub-cooling.
 - b. The condenser shall be provided with a capacitive type liquid level transducer with a resolution of not less than 1024 discrete steps. The transducer shall be wired to the chiller control system. Condenser liquid level measurement shall be used in the electronic expansion valve control algorithm with a minimum level set point to ensure adequate liquid seal is maintained in the condenser, to provide compressor motor cooling during operation. Condenser liquid level shall be clearly displayed on the graphical operator interface in a minimum of two screens. Chillers without direct level measurement are prohibited, due to possible over heating damage that may occur in compressors when liquid seal is lost.
 - c. Each compressor shall be installed with individual suction, discharge, and motor cooling refrigerant line isolation valves. Chillers without discharge line isolation valves that rely on non-return valves in the discharge line for compressor removal, shall not be accepted.
 - d. To prevent unit operation with no water flow, factory mounted and wired thermal dispersion water flow switches shall be provided on the condenser.

- e. The condenser shall be equipped with a mechanical stainless steel float for electronic actuation of the EXV, so as to provide a positive liquid seal to ensure effective cooling of the compressor
 - f. The evaporator shall be provided with spring loaded reseating type pressure relief valves, in accordance with ASHRAE-15. Rupture discs are not acceptable.
 - g. Load balancing valves shall be provided for capacity control and additional temperature stability.
 - h. There shall be a backup superheat control on the inlet of the compressor, in order to control the EXV in the event of a failure of the primary level sensing device.
5. Prime Mover:
- a. A permanent-magnet, synchronous hermetically sealed motor of sufficient size to effectively provide compressor horsepower requirements. The motor shall include soft-start capabilities with an in-rush current of no more than 2 amps (TT300 models) and 4 amps (TT400 models). The motor shall be liquid refrigerant cooled with internal thermal overload protection devices embedded in the winding of each phase.
 - b. The compressor motor and chiller unit shall include variable frequency speed controls to match cooling load demand to compressor speed and inlet guide vane position.
 - c. Each compressor shall be equipped with an AC line reactor and individual disconnect.
6. Chiller Frame & Housing
- a. All components shall be mounted onto a unitized construction, having a galvanized welded steel frame suitable for outdoor installation.
 - b. Compressors and controls shall be contained within a sheet metal enclosure to protect critical components from the weather.
7. Chiller Controls
- a. The controller fitted to the oil-free centrifugal chiller package shall be an embedded real time microprocessor device that utilizes control software written specifically for chiller applications. User operation shall be accomplished using a panel mounted color touch-screen interface. The status of the compressors and all system parameters, including compressor alarms and temperature trends, shall be viewable.
 - b. The chiller control system shall have the capability of storing one year of operational data. No less than 60 points of information shall be sampled at a maximum of 15 minute intervals.
 - c. The chiller control system shall have full web based remote control capability; including the capability of remote operation and software updates.
 - d. Controller features must include the following:
 - 1) Selectable control mode – leaving chilled water, entering chilled water, or suction pressure control.
 - 2) 10.4-inch or 12.1-inch or 15-inch, 65,000 colors, touch panel operator interface operating windows embedded.

- e. Chiller documentation shall be viewable via touch panel in pdf format.
- f. Operator interface shall be capable of connecting directly to compressors via serial communication protocol and display compressor information using Turbocor compressor monitoring / commissioning software.
- g. Chiller control panel shall contain a minimum of three processors; all control functionality shall be carried out on a dedicated real time processor and data served to a remote graphical user interface via an open Ethernet protocol. Proprietary protocols between any pc based or micro based processor are strictly prohibited.
- h. Chiller controls shall be native BacNet-IP capable. Addition of gateway devices or additional processors or pluggable PCBs to achieve BacNet communications to the BAS is strictly prohibited.
- i. Complete configuration of native BAS communications via BacNet IP shall be made via standard chiller controller graphical user interface. Chiller controls that utilize external software configuration tools to configure these protocols are explicitly prohibited.
- j. Chiller control shall be capable of controlling up to eight Turbocor compressors on up to eight individual refrigerant circuits serving the same chilled water stream.
- k. Chiller control panel user interface shall be capable of remote control via an internet connection without the use of any third party gateway device or additional hardware or software.
- l. Chiller control shall be capable of operating in headless mode (no touch panel connected) and utilize standard windows or higher computer to display user interface via Ethernet connection.
- m. Real time chiller control processor shall be capable of e-mailing a predefined list of recipients, should a fault occur. E-mail shall include details of fault, possible reason for fault, attachment of monthly data log of 195 or more compressor and chiller variables, and at a minimum interval of 30 seconds and with indication of severity of fault.
- n. Ability to place all outputs in a manual state (hand, off, auto) via graphical user interface.
- o. Alarm screen shall be capable of filtering faults into specific categories such as compressor, chiller and system faults in order to provide rapid diagnosis, and separation of failure modes.
- p. Variable speed cooling tower control.
- q. Ability to turn on/off duty standby chilled water pumps.
- r. Ability to operate chiller isolation valves.
- s. Multiple compressor staging algorithm shall operate at the optimized power curves of each compressor simultaneously, and shall reset automatically every second during operation. Compressor staging methods that operate using simple incremental percent of demand shall not be accepted.
- t. Continuous data logging for operational trending and bin analysis shall be exportable to "CSV" format. (12 months data stored).

- u. Embedded Web and FTP servers to enable remote encrypted control, log download, software version upload, and operational monitoring.
- v. Built-in stepper motor controls for EXVs.
- w. Controls lockup protection.
- x. Ramp rate control - Peak energy demand limiting algorithms.
- y. Three levels of alarm safety for minimum chiller down time.
- z. Chiller control software shall employ an active fault avoidance algorithm to reduce chiller capacity and/or power level in the case of the chiller approaching within 10% of any trip limit value such as suction pressure, discharge pressure, chiller amp limit, leaving chilled water temperature limit, etc...
- aa. Store up to 32,000 alarm and fault events stored with date / time stamp.
- bb. Real time data trending viewable via touch panel.
- cc. Chiller load profile charts viewable via touch panel.
- dd. Chiller control graphical user interface shall be capable of displaying data in SI or I-P units without affecting control or BAS protocol units.
- ee. Provide following features from chiller manufacturer:
 - 1) BMS interface module for the interface with BacNET IP shall be provided.
 - 2) Data on Main Display Screen shall include the following which shall also be mapped to the BMS system by the ATC contractor.
 - a) Entering and leaving chilled water temperatures.
 - b) Entering and leaving condenser water temperatures.
 - c) Current operating state of chiller.
 - d) Active timers.
 - e) Chiller enable status.
 - f) Chiller water flow proof status.
 - g) Condenser water flow proof status.
 - h) Indication of compressor readiness.
 - i) Indication of clearance to run.
 - j) Chiller set point.
 - k) Total chiller kW.
 - l) Total chiller current input.
 - m) Three pages of data trends with zoom functionality.
 - n) Graphical dial indicators that clearly indicate safe and unsafe operating values.
 - o) Graphical representation of evaporator and condenser showing gas movement when chiller is running.
 - p) Current alarms (announce and manual reset provision).

q) Compressor actual rpm, maximum rpm, minimum rpm.

K. EXECUTION

1. INSTALLATION

- a. Install per manufacturer's IOM documentation, shop drawings, and submittal documents.
- b. Align chiller on foundations or mounting rails as specified on drawings.
- c. Arrange piping to enable dismantling and permit head removal for tube cleaning.
- d. Coordinate electrical installation with electrical contractor.
- e. Coordinate controls and BMS interface with controls contractor.
- f. Provide all material required for a fully operational and functional chiller.

2. START-UP

- a. Units shall be field charged with HFC-134a refrigerant.
- b. Factory Start-Up Services: Provide factory supervised start-up on-site for a minimum of two working days and ensure proper operation of the equipment. During the period of start-up, the factory authorized technician shall instruct the owner's representative in proper care and operation of the equipment. Include on-site coordination with controls contractor for integration with BMS during start-up.

2.15 ROOFTOP AIR HANDLING UNITS (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

A. General

1. Rooftop air handling units shall be capable of 100 percent dedicated outside air design (DOAS). Units shall be of the configuration, capacity, and style as indicated on the drawings and Equipment Schedule and as specified herein. Through properly designed access; ease of maintenance, removability of components, and unit serviceability shall be assured.
2. The unit shall be constructed for outdoor installation. Outdoor unit to be provided with weatherproof outside air intake hood with aluminum mesh screen and shutoff dampers for supply, return and exhaust. Exhaust air discharge hood with aluminum mesh screen shall be provided.

B. General Description

1. Furnish as shown on plans. Unit performance and electrical characteristics shall be per the job schedule.
2. Provide the unit with the following sections as a minimum:
 - a. Modulating exhaust fan/economizer section
 - b. Filter sections
 - c. Modulating supply fan section
 - d. Access sections
 - e. Diffuser (as required)
 - f. Discharge/intake plenums

- g. Chilled water cooling coil
 - h. Hot Water Heating Coil
 - i. Static Membrane Plate Total Energy Recovery and Re-Heat Heat Exchangers
 - j. Roof curbs – per specification section 230548 and drawing requirements
3. The complete unit shall be ETL listed.
 4. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Units shall be of a modular design with factory installed access sections available to provide maximum design flexibility.
 5. Each unit shall be either completely factory assembled and shipped in one piece, when possible, or split between fan and energy recovery sections and the heating and cooling sections, if required for shipping, and then field assembly by HVAC Contractor. Unit manufacturer and HVAC subcontractor shall fully coordinate ship split, field installation, and all unit field inter-connection requirements.
 6. The unit shall undergo a complete factory run test prior to shipment. The factory test shall include final balancing of the supply and return fan assemblies, a unit control system operations checkout (limited to controls provided with unit), and a final unit inspection.
 7. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
 8. The Rooftop unit shall be designed, manufactured, and independently tested, rated, and certified to meet the seismic standards of the 2015 International Building Code, ASCE 7-05, and ASCE 7-06.
 - a. Certificates of Compliance shall be provided with the submittal and include the manufacturer's identification, designation of certified characteristics, and the Independent Certifying Agency's name and report identification.
 - b. Clear installation instructions shall be provided including all accessory components.
 9. Performance: All scheduled capacities and face areas are minimum accepted values. All scheduled amps, kW, and hp are maximum accepted values that allow scheduled capacity to be met.
 10. Warranty: The manufacturer shall provide 12-month parts only warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. The warranty period shall commence upon project completion date. Construction Manager and unit manufacture shall provide extended warranty if units are used for temporary heating/cooling purposes.

11. Quality Assurance: All unit(s) shall be factory run tested before shipping. A proof copy of the test shall be placed in the unit electrical power & control panel. Unit(s) shall bear the ETL label, tested in accordance to UL 1995. Electrical components shall be UL listed; fans shall be tested in an AMCA certified laboratory; insulation shall comply with NFPA 90A; water coils shall be tested in accordance to AHRI 410 ; energy recovery exchangers shall be in accordance to AHRI 1060, "Rating Air-to-Air Energy Recovery Equipment" and Eurovent standards; filters shall be tested in accordance to ASHRAE 52. The unit manufacturers construction shall have an independent testing agency test the air leakage, panel deflection and sound pressure levels for supply airflows of minimum 20,000 CFM. The air leakage of the unit(s) shall not exceed 1% at 8" inches H₂O positive static pressure and a copy of the report must be submitted upon request. Unit shall be constructed to limit frame and panel deflection to 1/250th of the panel length at 8" inches H₂O positive static pressure and a copy of the report must be submitted upon request. The unit shall also be tested in accordance with ANSI S12.34-1998 and instrumentation used must be in compliance with the requirements of AMCA 300 for sound readings. The sound tests conducted shall report overall sound power and pressure readings for supply air outlet, return air inlet and casing radiated.

C. Cabinet, Casing and Frame

1. Provide double-wall construction for all side wall access doors and floor areas shall be provided with minimum 18 gauge exterior and 20-gauge interior, solid aluminum with thermal breaks or thermo-composite construction with thermally broken aluminum lining construction. Inner liners shall protect insulation during service and maintenance. Unit cabinet shall be designed to operate at total static pressures up to 6.5 in. s.w.g.
2. Insulation on ceiling and end panels shall be secured with adhesive and mechanical fasteners. Heavy gauge solid galvanized steel liners shall be provided throughout, allowing no exposed insulation within the air stream.
3. All cabinet insulation, except floor panels, shall be a nominal 2 in. thick, R8.5, glass fiber. A combination of solid and perforated galvanized steel liners shall be provided throughout. Perforated liners to be used in the supply and return air plenums to provide improved sound attenuation. Insulation under perforated liners shall be coated with hospital grade liner rated in accordance with standard ASTM C-1071.
4. All floor panels shall include double wall construction and include a nominal 2 in. thick, R-12 foam or fiberglass insulation. Floor panels in air handling units shall be constructed to meet maximum allowable deflection and constructed of no lighter than 16 ga. Floor panels in service corridor sections shall be diamond aluminum or galvanized steel tread plate constructed of gauge (min. 10 ga) suitable to meet maximum deflection for structural capability for occupant and service equipment loading. Entire floor including floor drain pan and piping shall be insulated on underside to have same thermal and acoustical performance specified for unit housing.

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5. Exterior surfaces shall be constructed of pre-painted galvanized steel or thermally broken extruded aluminum for aesthetics and long term durability. Finished surface shall withstand a minimum 3,000-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.
 - a. Finish: Shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based. high performance thermoplastic organic coating applied to all exposed surfaces. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605. NAAMM - Metal Finishes Manual, and the following:
 - 1) Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis. Inc. product "Hylar 5000".
 - 2) Basis of Design: P.P.G. Industries Inc.: product "DuranarMica Sunstorm" in 'metallic' color to match Architect's control sample.
 - a) Finish Coating shall be manufactured as one of the following products:
 - b) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - c) Akzo Nobel: product: "Trinar Tri-Escent II."
 - d) Sherwin Williams (formerly Valspar), product: "Fluoropon Classic 11."
 - b. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM 05723 .
 - c. Primer: Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - d. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 1.00 mil dry film thickness.
 6. Service doors shall be provided for the units with vestibule sections and on service sides of each section in order to provide user access to all unit components. Finish shall be similar to unit casing finish.
 7. Service doors shall be constructed of extruded aluminum or galvanized steel with a interior liner. All service doors shall be mounted on multiple, stainless steel or heavy duty nylon hinges. The latch system shall feature a staggered engagement for ease of operation.
 8. The unit base frame shall be constructed of thermally broken pre-painted extruded aluminum or galvanized steel construction with a minimum of 5" pre-painted steel C-channel base. The unit base shall overhang the roof curb for positive water runoff and shall have a formed recess that seats on the roof curb gasket to provide a positive, weather-tight seal. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

D. Filters

1. Unit shall be provided with filter sections. The filter sections shall be supplied complete with the filter rack as an integral part of the unit. The draw-through filter section shall be provided with panel and cartridge filters.

2. Filters shall be frame mounted and shall slide into galvanized steel racks contained within the unit. Filters shall be installed in an angular arrangement to maximize filter area and minimize filter face velocity. Filters shall be accessible from both sides of the filter section.
 3. PRE-FILTERS (HIGH CAPACITY SERIES 400 2" MERV 10) - Filters shall be factory installed upstream of the heat exchanger and coils, in both airstreams. The filters shall be Filtration Group Series 400, MERV 10. Each filter shall consist of 100% synthetic media, expanded metal on the downstream and enclosing with high wet-strength beverage board with diagonal support bonded on air entering and air exiting side of each pleat. MERV 10 model High Capacity Serie 400 filters, UL 900 classified are rated as per ASHRAE test 52.2.2012 at 88% efficiency initial (based on Minimum Average Efficiency) at 3-10 microns. The model High Capacity Serie 400 could be operated at 500 FPM, surface area 18 FT² of media based on 24 x 24 x 2 initial static pressure at 0.24", final will be 1". Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.
 4. Final Filters – Supply Airstream - Four inch deep MERV 13, efficient, UL Std. 900, Class 1, AmericanAirFilter cartridge filters shall be provided. Two in. panel, MERV-8 efficient pre-filters shall be included. Aluminum mesh outside air filter shall be provided at the outside air hood inlet. Cartridge filters shall consist of filter media permanently attached to a metal frame and shall slide into a gasketed, extruded aluminum rack contained within the unit. The filter rack shall have secondary gasketed, hinged end panels to insure proper sealing. Filters shall be accessible from both sides of the filter section. Filter set quantities shall be provided as indicated in Part III.
 5. Clogged filter switches and magnehelic gauges shall be provided on all filter all sections.
- E. Outdoor/Exhaust/Return Air Section
1. Outdoor/Exhaust/Return Air Plenum- Unit shall be provided with a, outdoor/exhaust/return air plenum capable of handling 100 percent re-circulated air. The 100 percent return air plenum shall allow return air to enter from the bottom of the unit. Low leak dampers shall be provided. Damper blades shall be fully gasketed and side sealed and arranged vertically in the hood. Damper leakage shall be less than 0.2 percent at 1.5 in. static pressure differential. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers. Control of the dampers shall be from a field installed modulating actuator provided by the ATC Sub-subcontractor.

- F. **OA WEATHER HOOD:** The outdoor intake weather hood shall be completely constructed in aluminum, painted, or galvanized steel matching unit construction gage with minimum 3,000 hour salt spray tested finish for superior corrosion resistance. The hood shall ship loose for field installation by the installing contractor. Painted galvanized hoods shall not be acceptable due to its susceptibility to corrosion. The outdoor air hood shall be designed with a 4" extruded aluminum louver, bird screen and a plenum enclosure with drain holes. The louver blades shall be drainable type with a maximum 45 degree angle and curved with integral rain baffle. The louver design shall not allow more than 0.03 oz/ft² water penetration when tested in accordance to AMCA 500. The pressure drop of the complete hood assembly shall not exceed 0.05"wc at a maximum 500 fpm face velocity. Where OA hoods are provided with pre-fitted, filter access in the hood shall be accomplished via the louver that is installed with a stainless steel piano hinge and spring loaded latch. No tools or ladders shall be required to access the pre-filters in the weather hood assembly. The exhaust air outlet louvers shall be 2" extruded aluminum, with non-restricting blade design and bird screen.
- G. **Energy Recovery Section and Components**
1. **SENSIBLE REHEAT FIXED PLATE HEAT EXCHANGERS:** Fixed plates heat exchangers shall factory installed where indicated on drawings. The heat exchanger shall be a cross flow plate air-to-air type. The alternate layers of plate create two ducts, one for supply air and one for exhaust air. The plates shall be in pure aluminum for its characteristics of corrosion resistance, ease of manufacture, flame proof, durability and excellent heat transfer properties (option: For aggressive and corrosive applications, the plates shall be coated aluminum or various grades of stainless steel. For special applications with high temperature, plates shall be stainless steel). Minimum plate thickness shall be .008", with positive and negative stamping for spacing and turbulence. The plates shall be sealed at air entry and exit to avoid air leakage and separate exhaust and supply air by proper seals. The plates shall be housed inside a casing composed of corner profiles and side walls. The corners of the exchanger package shall be cast and sealed into especially rigid aluminum extrusions in the casing with permanent elastic non acetic silicone. The side walls shall be manufactured from galvanized steel sheets and bolted to the aluminum extrusions. Plates shall be able to withstand up to 10" pressure differential and 400°F operating temperature when required. The fixed plate heat exchanger assembly shall be tested and certified in accordance to ARI1060 and to ASHRAE 84-91. Access for all four sides of the heat exchanger shall be provided for cleaning and inspection. Temperature and pressure drop performance shall be equal or less than what is scheduled. Stainless Steel drain pan shall be provided underneath the entire Fixed Plate with 1" stainless steel drains with PVC or stainless steel drain connection on each 4 sides of the heat exchanger. Drain connections protrude through the side of the unit. Note: Drain lines must be properly trapped and freeze protected in field by HVAC Contractor, and HVAC Contractor shall route drain lines to nearest roof drain. Frost control shall be accomplished by face & bypass damper where temperatures fall below freezing. Any other form of defrost shall not be acceptable.

2. ENERGY RECOVERY ENTHALPY PLATE HEAT EXCHANGERS: Enthalpy plates heat exchangers shall be factory installed where indicated on drawings. The heat exchanger shall be a cross flow plate air-to-air type. The alternate layers of plate create two ducts, one for supply air and one for exhaust air. The plates shall be in pure porous membrane with desiccant material with the ability to transfer sensible and latent heat. The plates shall be sealed at air entry and exit to avoid air leakage and separate exhaust and supply air by proper seals. The plates shall be housed inside a casing composed of corner profiles and side walls. Plates shall be able to withstand up to 4" pressure differential. The plate heat exchanger assembly shall be tested and certified in accordance to AHR11060 and to ASHRAE 84-91, or EUROVENT standard. Access for all four sides of the heat exchanger shall be provided for cleaning and inspection. Temperature and pressure drop performance shall be equal or less than what is scheduled. Stainless Steel drain pan shall be provided underneath the entire Plate with 1" stainless steel drains on each (2) or 4 sides of the heat exchanger. Drain connections protrude through the side of the unit. Note: Drain lines must be properly trapped and freeze protected in field by HVAC Contractor, and HVAC Contractor shall route drain lines to nearest roof drain. Frost control shall be accomplished by face & bypass damper where temperatures fall below freezing. Any other form of defrost shall not be acceptable.
- H. FANS: The fans shall be carefully positioned and installed at an optimal distance to respect uniform airflow across the heat exchanger & coil(s).
1. Plenum Fans ER model: Fans shall be direct drive radial centrifugal fans with free running impeller. No fan belts will be acceptable for this application. Fans shall be compact, optimized and construction made of galvanized sheet steel with backward curved 7-blade high efficiency impeller, protected by an epoxy powder coating. To reduce vibration, the impeller shall be balanced with hub to an admissible vibration severity of less than 2.8 mm/s in conformity with DIN ISO 14694 and proof shall be supplied for each individual impeller. Tests shall be made according to DIN ISO 1940 Part 1, quality of balancing G2.5/6.3. The single inlet shall be mounted onto constant speed direct drive motor, equipped with an air flow optimized inlet cone from galvanized sheet steel. Fans shall be completely certified as per ISO 5801 and in accordance to AMCA standards. Fan/ fan bank will require to be operated by a Variable speed drive or one VFD per fan shall be provided w/ Automatic Control backdraft isolation damper that shall close in event of a fan failure. Plenum fan shall come equipped with guard grilles for the air intake side.
 2. The fan housing and motor assembly shall be isolated from the unit cabinetry with a minimum 95% efficient isolators. Fan(s) shall have flexible duct canvas and galvanized spring isolators. Painted isolators are unacceptable. Provide Heavy duty spring or rubber isolators for all fan sizes.

3. Plenum Fans GR model: Wall mounted, direct driven plenum fans (horizontal or vertical) shall be installed with perimeter gasketed isolation. Fans shall be direct drive radial centrifugal fans with free running impeller. Fans shall be compact, optimized and construction made of galvanized sheet steel with backward curved 7-blade high efficiency impeller, protected by an epoxy powder coating. To reduce vibration, the impeller shall be balanced with hub to an admissible vibration severity of less than 2.8 mm/s in conformity with DIN ISO 14694 and proof shall be supplied for each individual impeller. Tests shall be made according to DIN ISO 1940 Part 1, quality of balancing G2.5/6.3. The single inlet shall be mounted onto constant speed direct drive motor, equipped with an air flow optimized inlet cone from galvanized sheet steel. Fans shall be completely certified as per ISO 5801 and in accordance to AMCA standards. Fan/ fan bank will require to be operated by a Variable speed drive or one VFD per fan shall be provided w/ Automatic Control backdraft isolation damper that shall close in the event of a fan failure . Optional: Plenum fan shall come equipped with guard grilles for the air intake side.
4. Base mounted fan housing and motor assemblies shall be isolated from the unit cabinetry with a minimum 95% efficient spring isolators with 2" deflection and seismic restraints per Specification Section 230540 requirements. In addition, fans shall have flexible canvas to reduce vibration transmission. Isolate wall mounted fan types per manufacturer's requirement.
5. SOUND ATTENUATION IN FAN COMPARTMENT: The fan section shall be constructed with a perforated interior liner, same construction as the housing interior lining and shall be insulated with Permacote anti-microbial coating fiber glass. The perforated lining shall be installed on fixed panels only, with exception on the interior ceiling.
6. FAN MOTORS: The fan motors shall meet NEMA standard dimensions and comply with the Energy policy Act of 1997. Motors shall have premium efficiencies with low noise and vibration output. Motors shall be certified and built in accordance to ISO 9001 quality control system. Motors shall have ODP enclosure with Premium efficiency rating.
7. A shaft grounding brush kit will be provided to prevent electrical damage to motor bearings by safely channeling harmful shaft currents to ground.
8. VARIABLE FREQUENCY DRIVE (VFD) – VFDs will be used to set or regulate the fan speed and airflow for these units. The VFD shall have PID function for constant flow applications. The VFDs will be installed with integral brake transistor, overload protection, and adjustable pulse-width modulation (PWM). The VFD shall use Insulated Gate Bipolar Transistor (IGBT) technology to convert three phase input power to coded PWM output and have 4-20mA analog output terminals that are fully programmable for variable flow applications. The VFD shall be equipped with a keypad with status indicators, easy access functions, and monitoring functions during motor operation. In the event of a momentary power failure or fault the VFD shall read the inverter speed and direction of a coasting motor and shall automatically restart the motor smoothly. Technical support will be provided by the VFD manufacturer. VFDs shall be installed as shown on drawings with contactors, relays, and all specified accessories. VFDs will be installed with 3% line reactors and manual bypass.

- I. Dampers: Dampers shall be installed where shown on the drawings. Dampers shall be low leak type with rubber edges, opposed blades, and constructed from extruded aluminum. Galvanized dampers will not be acceptable. The exhaust air outlet shall have a standard aluminum gravity type damper, unless otherwise noted.
 1. Dampers shall be installed in the compartments (as shown on the drawings) with linkage rod for actuators:
 2. Actuators shall be 24V factory and furnished by the ATC contractor; two-position or modulating type (refer to the HVAC control drawings). All actuators shall have spring return mechanism and auxiliary switches. Dampers will be installed in the failed close position unless otherwise noted.

- J. WATER COILS
 1. Coils shall be are factory installed in the unit. Primary surface shall be round seamless 5/8" OD copper tube staggered in the direction of airflow. Secondary surface shall consist of rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates. Casing shall be constructed of continuous stainless steel. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 60" and shall not exceed 500 FPM face velocity. Inner face of cooling coil section panels and cooling coil frame shall be constructed of minimum 18 gauge 304 type stainless steel.
 2. Drain pan shall be provided for cooling coils. Cooling coils shall sit on stainless steel tubular support rails, which shall stand a minimum of (2) two inches above the highest point of the floor drain pan. Stacked coils shall be provided for larger airflows and intermediate drain pans, sloped to drain connection, shall be provided for each coil bank. Drain pans shall be minimum 1.5" 304 stainless steel with all welded seams and with stainless steel drain connections on one side only. Pan shall be sloped in two planes. All coils shall be certified in accordance with ARI standard 410. Manufacturer shall provide performance data for hot water coils utilizing 35% propylene glycol and chilled water coils is using 30% propylene glycol to meet the schedules heating and cooling performance shown on HVAC RTU Schedules.

K. POWER & SAFETY CONTROL

1. The power and control center shall be integral to the unit housing and rated equivalent to NEMA 4X. UNDER NO CIRCUMSTANCES SHALL ANY WIRING OR PARTS BE FIELD INSTALLED. Panels that are externally mounted to the unit shall not be accepted, regardless of the NEMA rating they may have. A separate access door shall be provided with an approved locking device. All electrical components contained in the panel shall be UL/CSA certified and labeled. The unit shall be complete with VFDs, fuses, overloads (without VFD's or 2 motors on same VFD; one VFD per fan w/isolation damper), relays, phase protection for compressorized units, terminals for main ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit. A non-fused safety disconnect switch shall be factory installed for ON/OFF servicing. An electrical pipe chase for power and control feeding shall be provided next to the control panel. Any power or control wiring that is field installed shall be installed in full conformance with code and manufacturer's requirements and recommendations. The Short Circuit Current Rating (SCCR) is 5kA rms symmetrical, 600V Maximum.

L. SERVICE POWER & LIGHTING

1. GFI, lights and switches shall be factory installed and wired to a common junction box. A separate power connection 120V/1 will be required. 120V/1 power will be connected to a branch circuit provided by Division 260000.

M. Access Sections - Unit shall be provided with factory installed access sections located as shown/indicated on the drawings. Access sections shall have hinged access doors on both sides of the section and shall have the same construction features as the rest of the unit.

N. Discharge and Return Plenum - A supply air discharge and return plenum shall be provided. The plenum section shall be lined with a perforated acoustic liner (rated per ASTM C1071 Standards) to enhance sound attenuation. The plenum section shall have a bottom discharge opening. Isolation dampers shall be provided in the bottom return air opening and bottom supply air openings. Actuators shall be provided by the ATC Sub-subcontractor to close the dampers when the fans are not running. Refer to Specification Section 230548, Paragraph 2.2.A.22 and drawing details for rooftop curb, plenum, and sound barriers package requirements.

O. Roof Curb – refer to Specification Section 230548, Paragraph 2.2.A.22 and drawing details for requirements.

P. Controls

1. General – Automatic Temperature controls for Rooftop unit shall be DDC (direct digital control type). All sensors, actuators, and operating controls shall be provided by the ATC Contractor.
2. Unit manufacturer shall provide terminal strips for any and all manufacturer provided control devices not provided by ATC Sub-subcontractor.
3. Refer to Control Diagram Drawings for Rooftop unit control requirements and expanded sequence of operation and required points list, for reference only.

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4. RTU manufacturer shall provide the necessary coordination time and documentation to the ATC sub-subcontractor to achieve the specified RTU system control.

Q. Manufacturers

1. Subject to compliance with requirements specified here within provide rooftop units as manufactured by Annexaire, Haakon, Multistack, Engineered Air, Seasons 4, Custom Air Handling Solutions, or approved equal by the engineer. (Rooftop Unit must fit within the footprint and unit weights shall be within 5%, have similar weight (within 5% of Basis of Design unit) as shown on the drawings and schedules with manufacturer's recommended service clearances and code mandated airstream clearances being maintained)
2. Any substitution or equal manufacture must fit within the equipment footprint shown on the Drawings and meet the scheduled sound data.

2.16 TERMINAL HEATING UNITS (HYDRONIC) (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

A. Finned Tube Radiation:

1. General: Provide finned tube radiation of lengths and in locations as indicated, and of capacities, style, and having accessories as scheduled.
2. Cabinets: Minimum 18-ga cold-rolled steel full backplate, minimum 14-ga front. Brace and reinforce front minimum of 4 ft.-0 in. o.c. without visible fasteners.
3. Elements: Copper tube and aluminum fins, or steel tube and steel fin (as scheduled) with tube mechanically expanded into fin collars to eliminate noise and insure durability and performance at scheduled ratings.
4. Finish: Flat black heat resisting paint for backplate; factory finished baked enamel on fronts and accessories. Submit color selection chart to Architect as part of submittal package.
5. Accessories:
 - a. End panels, inside and outside corners, and enclosure extension.
 - b. Access panels in front of valves, balancing cocks, and traps.
 - c. Factory-mounted dampers.
 - d. Ball bearing hangers.
6. Manufacturer: Subject to compliance with requirements, provide finned tube radiation of one of the following:
 - a. Vulcan Corp.
 - b. Rittling
 - c. Sterling Radiator; Div. of Reed National Corp.
 - d. Or equal

B. Hydronic Fan-Coil Units:

1. General: Provide fan-coil units having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. Include in factory assembled unit, chassis, coils, freezestat, fanboard, fans, housing, ECM motor, filter, modulating 0-10V control valve package and insulation. All automatic controls and communication interface board for BMS integration shall be provided by the unit manufacture.
2. Chassis: Construct chassis of galvanized steel with flanged edges.
3. Insulation: Faced, heavy density glass fiber.
4. Cabinet: Construct of 16-ga steel removable panels, 16-ga front. Provide insulation over entire coil section. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer and finish paint color as selected by architect.
5. Coils: Construct of 5/8" seamless copper tubes mechanically bonded to configured aluminum fins. Design for 300 psi working pressure, and leak test at 300 psi under water.
6. Fans: Provide centrifugal forward curved double width wheels of reinforced fiberglass, in galvanized steel fan scrolls.
7. Motors: Provide ECM motors with integral thermal overload protection. Run test motors at factory in assembled unit prior to shipping. Provide quickly detachable motor cords. Provide speed dial for speed control.
8. Filters: Provide 1" thick MERV 8 throwaway type filters in fiberboard frames.
9. Accessories: Provide ducted inlet and outlet collars.
10. Manufacturer: Subject to compliance with requirements, provide fan-coil units of one of the following:
 - a. Rittling
 - b. Trane
 - c. McQuay Inc.
 - d. Or equal

C. Unit Heaters (UH) (Horizontal Type)

1. General: Provide horizontal unit heaters in locations as indicated, and of capacities, style, and having accessories as scheduled.
2. Construction:
 - a. Casings: Construct of steel, phosphatized inside and out, and finished with baked enamel. Provide adjustable face air diffuser.
 - b. Fans: Construct of aluminum and factory-balance. Design so motor and fan assembly is removable through fan outlet panel.
 - c. Coils: Construct of plate-type aluminum fins, mechanically bonded to copper tubes. Design coil for use in hot water applications.
 - d. Motors: Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

3. Manufacturer: Subject to compliance with requirements, provide horizontal unit heaters of one of the following:
 - a. Rittling
 - b. Sterling
 - c. Price
 - d. Or Equal.
- D. Unit Heaters (UH) (Cabinet Type)
1. General: Provide cabinet unit heaters having cabinet sizes and in locations as indicated, and of capacities, style, and having accessories as scheduled. Include in basic unit chassis, coil, fanboard, fan wheels, housings, motor, and insulation.
 2. Construction:
 - a. Chassis: Galvanized steel wrap-ground structural frame with edges flanged.
 - b. Insulation: Faced, heavy density glass fiber.
 - c. Cabinet: 14-ga removable front panel, 18-ga top and side panels. Insulate front panel over entire coil section. Provide access door on coil connection side. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer and baked enamel finish paint with color as selected by Architect. Provide sample selection chart.
 - d. Water Coils: Construct of 5/8 in. seamless copper tubes mechanically bonded to configured aluminum fins. Design for 300 psi and leak test at 300 psi under water. Provide same end connections for supply and return.
 - e. Fans: Provide centrifugal, forward curved double width fan wheels constructed of non-corrosive, molded, fiberglass reinforced thermo-plastic material. Construct fan scrolls of galvanized steel.
 - f. Motors: Provide shaded pole motors with integral thermal over-load protection, and motor cords for plug-in to junction box in unit. Provide motor speed switch with auxiliary contacts capable of being remotely controlled by the DDC system.
 - g. Filters: Provide 1 in. thick throwaway type filters in fiberboard frames.
 3. Manufacturer: Subject to compliance with requirements, provide cabinet heaters of one of the following:
 - a. Rittling
 - b. Sterling
 - c. Price
 - d. Or Equal.
- E. Radiant Panels (RP)
1. Modular Radiant Panels:
 - a. Modular radiant panels shall use heat sinks on the back of a rigid ceiling tile to transfer heat between copper tubes and the panel face. The modular radiant panels are to radiate or absorb heat from or to the zone below.

- b. Water Tubes: Tubes shall consist of ASTM B75 ½" nominal copper tubing. Water connections shall be one end only. Water connections shall be suitable for solder, compression fittings, push-on fittings or threaded connection.
 - c. Heat Sinks: Heat sinks shall be extruded aluminum and copper pipe will be mechanically fastened to the heat sink. A nonhardening heat transfer paste is required between the tubing and the heat sink and between the heat sink and the panel.
 - d. Face: The panel face shall be constructed of 18 or 14 ga. aluminum
 - e. Paint Finish: All visible components shall be powdercoated with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Manufacturer shall provide water pressure drop data as well as heat and cool output data derived from tests in accordance with DIN 14037 (heating) and DIN 14240 (cooling).
 - f. Color to be chosen by Architect.
 - g. Modular radiant panel capacity shall be tested and certified by manufacturer in accordance with DIN 14037 (heating) and DIN 14240 (cooling) to meet the performance listed on the schedule. Should any performance rating, chilled water supply temperature, water pressure drop, percentage of glycol, GPM or delta T deviate from the schedule, manufacturer shall submit updated capacity as described in Section 1.3, as well as computational fluid dynamic modeling demonstrating that any changes do not impact the air distribution in a room that would cause a detriment to the PMV and ADPI rating from the design conditions. Manufacturer shall have factory testing facility available to perform performance test of units in accordance with said standard, as required. Upon request, up to 1% of units for the project can be tested in accordance with the standard. Request will be made with order and prior to shipment of chilled sails. Engineer will have the option of witnessing this test.
 - h. Water connections shall be shipped sealed to limit the introduction of dust and dirt during shipping and construction.
 - i. Accessories:
 - 1) Manufacturer shall supply upon request 12"/18" stainless steel braided hose with isolation ball valves as required.
 - 2) Panel manufacture shall provide all necessary inter-connectors, fittings, hanger brackets, installation kits, pipe headers, accessories, supports, 1" flexible unicellular (foam insulation), and any other components as required for a complete radiant panel system.
2. Linear Radiant Panels
- a. Linear radiant panels shall use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face. The linear radiant panel is to radiate or absorb heat from or to the zone below.
 - b. Water Tubes: Tubes shall consist of ASTM B75 ½" nominal copper tubing. Water connections shall be one end only. Water connections shall be suitable for solder, compression fittings, push-on fittings or threaded connection.

- c. Heat Sinks: Heat sinks shall be extruded aluminum and copper pipe will be mechanically fastened to the heat sink. A non-hardening heat transfer paste is required between the tubing and the heat sink.
 - d. Extruded Aluminum Plank: The panel shall be constructed of 1.2 mm thick extruded aluminum
 - e. Paint Finish: All visible components shall be powdercoated with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Manufacturer shall provide water pressure drop data as well as heat and cool output data derived from tests in accordance with DIN 14037 (heating) and DIN 14240 (cooling).
 - f. Color to be chosen by Architect.
 - g. Linear radiant panel capacity shall be tested and certified by manufacturer in accordance with DIN 14037 (heating) and DIN 14240 (cooling) to meet the performance listed on the schedule. Should any performance rating, chilled water supply temperature, water pressure drop, percentage of glycol, GPM or delta T deviate from the schedule, manufacturer shall submit updated capacity as described in Section 1.3, as well as computational fluid dynamic modeling demonstrating that any changes do not impact the air distribution in a room that would cause a detriment to the PMV and ADPI rating from the design conditions. Manufacturer shall have factory testing facility available to perform performance test of units in accordance with said standard, as required. Upon request, up to 1% of units for the project can be tested in accordance with the standard. Request will be made with order and prior to shipment of chilled sails. Engineer will have the option of witnessing this test.
 - h. Water connections shall be shipped sealed to limit the introduction of dust and dirt during shipping and construction.
 - i. Accessories:
 - 1) Manufacture shall supply upon request 12"/18" stainless steel braided hose with isolation ball valves as required.
 - 2) Panel manufacturer shall provide all necessary inter-connectors, fittings, hanger brackets, installation kits, pipe headers, accessories, hangers, supports 1: flexible unicellular (foam insulation), trimmable panels, end caps for a continuous look wall to wall and any other component as required for a complete radiant panel system.
3. Approved Manufacturers:
- a. Rittling
 - b. Sterling
 - c. TWA
 - d. Or Equal

F. Light Shelf Radiant Heating Panels

- 1. Light Shelf Radiant Panels
- 2. Linear radiant panels shall use extruded aluminum with integrated heat sinks on the back to transfer heat between copper tubes and the panel face. The linear radiant panel is to radiate or absorb heat from or to the zone below.

3. Water Tubes: Tubes shall consist of ASTM B75 5/8" nominal copper tubing. Water connections shall be one end only. Water connections shall be suitable for solder, compression fittings, push-on fittings or threaded connection.
4. Heat Sinks: Heat sinks shall be extruded aluminum and copper pipe will be mechanically fastened to the heat sink. A non-hardening heat transfer paste is required between the tubing and the heat sink.
5. Extruded Aluminum Plank: Panels shall be interlocked using tongue & groove connections and be held together using aluminum or steel cross channels with spring clips. The panels shall be installed utilizing the concealed method. The panel shall be constructed of a minimum 1.2 mm thick extruded aluminum with a castellated face finish and corner profile.
6. Paint Finish: All visible components shall be powdercoated with highly emissive powder coat polyester paint for optimal radiative properties as well as durability and easy cleaning. Manufacturer shall provide water pressure drop data as well as heat and cool output data derived from tests in accordance with DIN 14037 (heating) and DIN 14240 (cooling).
7. Standard Color: color to be chosen by the architect, provide sample selection chart.
8. Light shelf radiant panel capacity shall be tested and certified by manufacturer in accordance with DIN 14037 (heating) and DIN 14240 (cooling) to meet the performance listed on the schedule. Should any performance rating, hot water supply temperature, water pressure drop, etc. deviate from the schedule, manufacturer shall submit updated capacity as described in Section 1.3, as well as computational fluid dynamic modeling demonstrating that any changes do not impact the air distribution in a room that would cause a detriment to the PMV and ADPI rating from the design conditions. Manufacturer shall have factory testing facility available to perform performance test of units in accordance with said standard, as required. Upon request, up to 1% of units for the project can be tested in accordance with the standard. Request will be made with order and prior to shipment of chilled coils. Engineer will have the option of witnessing this test.
9. Water connections shall be shipped sealed to limit the introduction of dust and dirt during shipping and construction.
10. Accessories:
 - a. Manufacturer shall supply upon request 12"/18" stainless steel braided hose with isolation ball valves as required.
 - b. Panel manufacturer shall provide all necessary inter-connectors, fittings, hanger brackets, installation kits, pipe headers, accessories, supports, 1" flexible unicellular (foam insulation), and any other components as required for a complete radiant panel system.
11. Panel manufacturer shall provide all necessary inter-connectors, fitting, hanger brackets, installation kits, pipe headers, accessories, 1" foil-back insulation, trimmable panels, mounting arm for installation and any other unit components as required for a complete radiant system.
12. Approved Manufacturers:
 - a. Price
 - b. TWA

- c. Sterling
- d. Or Equal

G. Wall Radiation Units

1. General: Provide steel double panel radiators of the lengths and in locations as indicated, and of capacities, style and having accessories as scheduled. The double heating panel radiation shall be of one-piece all-welded steel construction, consisting of a pair of flattened water tube panels welded to headers at each end. Welded to the inside of each panel shall be steel corrugated fins to increase the convective output of the radiator. The fins shall start at no less than 3" from the end of the radiator, and shall have no less than 32 fins per foot. A third set of fins shall be added to the backside of the radiator for maximum convective output. The radiators shall include an integral heavy gauge (0.09" minimum) all-welded perforated top grille, which will cover the top of all of the finned areas. Provide all required supports.
2. The headers shall include all necessary inlet, outlet and vent connections as required. Standard connection sizes are 1/2" NPT tapered thread for supply and return piping, and 1/8" for the vent connection. Internal baffling is provided where required for proper water flow.
3. The radiant heating panels shall be available in lengths from 2'-0" to 29'-6" in two inch even increments without the need for splicing. The panel radiation shall be capable of being mounted to typical stud wall construction without additional blocking or strapping. Appropriate wall mounting brackets shall be provided with the radiation.
4. Panel radiation expansion shall not exceed 1/64" per foot of radiation at 215°F. The installer shall provide adequate expansion compensation for each radiator.
5. Finishes: The panel radiation shall be cleaned and phosphatized in preparation for the powder coat finish. The radiation is then finish painted with a gloss powder coat finish, for a total paint thickness of 2-3 mils (0.002" - 0.003"). The color shall be selected by the Architect. Provide ribbed pipe cover trims, finished to match the radiator.
6. Warranty: All radiators are covered by a 5-Year Limited Warranty.
7. Manufacturer: Subject to compliance with requirements, provide flat tube panel radiation as manufactured by:
 - a. Sterling
 - b. Runtal North America, Inc.
 - c. Rittling
 - d. Or equal

- H. General: refer to HVAC Control Drawings for terminal heating equipment control requirements.

2.17 TERMINAL HEATING UNITS (ELECTRIC) (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. Electric Propeller Unit Heaters (UH)
1. Materials and Equipment:
 - a. General: Except as otherwise indicated, provide manufacturer's standard electric propeller unit heater materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for a complete installation.
 2. Heating Elements:
 - a. General: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities, and ratings for duty indicated; consisting of resistance elements in steel sheath with extended fins, or with spirally finned sheath.
 - b. Heating Capacity: Size elements for indicated fan speed, CFM, room heating load (BTUH), entering air temperature, and electric inputs (watts, voltage, phase).
 3. Casings:
 - a. General: Provide casings braced and reinforced to provide required stiffness, and with adjustable heating element supports and brackets. Provide rounded corners. Phosphatize and paint casings inside and out with single coat of baked-on enamel; and zinc plate hardware. Include fan orifice (venturi) in casing, as well as threaded hanger connections (weld nuts). Fabricate from 18-gage galvanized steel.
 4. Air Deflectors:
 - a. General: Provide manufacturer's standard air deflectors of the following types:
 - 1) 4-way finned louvers.
 - 2) Cone diffusers.
 - 3) Vane outlets.
 - 4) Louver outlets.
 5. Motors:
 - a. General: Provide totally enclosed shaded-pole, or permanent-split capacitor motors, Class "B" insulation, resiliently mounted, tap wound with built-in thermal overload protection, and with sleeve type or permanently lubricated ball bearings.
 - b. Internal Electrical Wiring: Provide units with high temperature, heat-resistant electrical wiring enclosed in flexible metal conduit extending from terminal junction box to electrical devices. Provide fusing for motor and control circuit wiring.
 - c. Devices: Provide propeller unit heaters with the following devices:
 - 1) Thermally activated fan switch to keep fan motor operating until residual heat is dissipated.
 - 2) Disconnect switch.

- 3) Automatic reset, high limit cut-out switch located in discharge air stream.
 - 4) Magnetic contractor.
 - 5) Transformer.
6. Fans:
- a. General: Provide aluminum propeller fans which are balanced statically and dynamically, of indicated capacity. Provide fans suitable for standard or sparkproof application.
7. Manufacturers: Subject to compliance with requirements, provide propeller unit heaters of one if the following:
- a. Chromalox Div.; Emerson Electric Co.
 - b. Federal Pacific Electric Co.
 - c. Gould Inc.
 - d. Markel Nuton Div.; Scoville Inc.
 - e. TPI Corporation.
 - f. Qmark
 - g. Or Equal.
- B. Electric Ceiling Heating Panels
1. The electric ceiling heating panel shall be as manufactured by Berko, A Division of Marley Engineered Products, INEECO, Thermal Equipment Sales, or equal. The construction and design shall permit it to be: recessed ceiling mounted with the use of Recessed Mounting Kit, fit into standard or custom designed modules of a T-bar suspended ceiling, or surface mounted with the use of a Surface Mounting Kit. Panels shall include the custom features listed below.
 2. HEATING ASSEMBLY: The heating assembly shall be UL Listed and CSA Certified and shall consist of powdered graphite encapsulated in a plastic laminate with heavy duty copper buss bars running the entire length, backed by 1 inch, 1 pound density high temperature fiberglass insulation to insulate against heat loss to the ceiling and separated from the inside of the panel by a dielectric insulation to assure uniform heat transfer throughout the entire radiating surface of the heater. The rated input shall be: (62.5 watts/sq. ft. with an average temperature of not more than 165 degree F.) or (95 watts/sq. ft. with an average surface temperature of 200 degree F.), to assure long trouble free life. The panel voltage shall be 208V.
 3. WIRING: For connection to the main power supply, the heater shall be completely prewired, with the lead wires housed in a 48 inch length of flexible metal conduit and connector for J-Box mounting. Appropriate wiring diagrams shall appear on the back of the panel.
 4. PANEL ASSEMBLY: The metal heating panel, containing the completely prewired heating assembly, shall be of 22 gauge formed galvanized steel front and 24 gauge formed galvanized steel back. Sides are overlapping front and back panels riveted together.
 5. FINISH: The front of the heating panel shall be unique multi-faceted crystalline type surface finished with high temperature silicone paint.

6. SURFACE MOUNTING Surface Mounting Kit shall come in a separate carton which contains: two side frames, two end frames and eight assembly screws. Frame shall be field assembled before installing on ceiling.
 7. RECESS MOUNTING Recess Mounting Kit shall come in a separate carton which contains: four frame sections and four corner pieces.
- C. Electric Cabinet Unit Heaters
1. Materials and Equipment:
 - a. General: Except as otherwise indicated, provide electric cabinet heater manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
 2. Heating Elements:
 - a. General: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities and ratings for duty indicated; consisting of resistance elements enclosed in steel sheath with extended fins, or with spirally finned sheath.
 - b. Electric Heating Capacity: Size elements for indicated fan speed, CFM, room heating load (BTUH), entering air temperature, and electric input (watts, voltage, phase).
 3. Cabinets:
 - a. General: Provide cabinets braced and reinforced to provide required stiffness, and with adjustable heating element supports. Provide 1/2" thick, 2 lb. density, glass fiber insulation on interior of front panel. Phosphatize and paint cabinets inside and out with single coat of baked-on primer. Include discharge air grilles in cabinet, die formed with fixed directional louvers. Provide cabinets with removable front panels secured by slide bolt, camlock or Phillip head type screws. Fabricate from 16-gage galvanized steel.
 - b. Cabinet Accessories: Provide manufacturer's standard accessories of the following types; manufacturer's option applies where more than one type is indicated for each accessory.
 - 1) Gaskets for installation between front panel and enclosure; of manufacturer's standard gasket material.
 - 2) Discharge duct collars.
 - 3) Inlet duct collars.
 - 4) Hinged access doors with tamper-proof latches.
 - 5) Disposable air filters, 1" thick.
 - 6) Tamper-proof panel fasteners consisting of either allen head type machine screws, or spanner wrench type operating cam fasteners.
 - 7) Overlap on 3 or 4 sides (as required) for recessed and semi-recessed cabinets to concealing recesses.
 - c. Cabinet Finish: Provide factory finishes of the following:
 - 1) Special finishes of the type indicated.
 - 2) Baked enamel finishes selected from manufacturer's standard colors.

4. Motors:

- a. General: Provide totally enclosed shaded-pole, or permanent-split capacitor motors, Class "B" insulation, resiliently mounted tap wound with built-in thermal overload protection, and with permanently lubricated type sleeve or ball bearings.
- b. Extended Motor Oilers: Provide plastic tubes for lubricating motor bearings which are installed beneath grille.
- c. Motor Controls: Provide multi-speed motor control switch with OFF position, mounted behind access door.
- d. Internal Electrical Wiring: Provide units with high temperature, electrical heat-resistant wiring in flexible metal conduit from terminal junction box to electrical devices. Provide fusing for motor and control circuit wiring.
- e. Devices: Provide cabinet heaters with the following devices:
 - 1) Thermally activated fan switch to keep fan motor operating until residual heat is dissipated.
 - 2) Disconnect switch.
 - 3) Automatic reset, high limit cut-out switch located in discharge air stream.
 - 4) Magnetic contractor.

5. Fans:

- a. General: Provide double width, double inlet centrifugal fans, which are balanced statically and dynamically, of indicated capacity. Select fans with single or double extended motor shaft, with fan housing and motor fastened as an integral assembly to a motorboard.

6. Construction:

- a. Wheels: Talc-filled polypropylene or aluminum.
- b. Housing: Galvanized steel.
- c. Motorboard: Galvanized steel.

7. Vibration Isolation: Provide types and sizes of vibration isolators as recommended by manufacturer.

8. Manufacturers: Subject to compliance with requirements, provide cabinet heaters of one of the following:

- a. American Air Filter Co.
- b. Chromalox Siv.; Emerson Electric Co.
- c. Federal Pacific Electric Co.
- d. General Electric Co.

D. ELECTRIC FINNED-TUBE RADIATION (EFT)

1. Materials and Equipment:

- a. General: Except as otherwise indicated, provide manufacturer's standard electric finned-tube radiation materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for a complete installation.

2. Heating Elements
 - a. General: Except as otherwise indicated, provide manufacturer's standard heating elements of types, sizes, capacities and ratings for duty indicated; consisting of aluminum-sheather electric resistance elements enclosed in aluminum tube which is mechanically expanded into aluminum fins, and equip with a capillary type automatic reset thermal overheat cutout.
 - b. Heating Capacity: Size elements based on ratings or required output (BTUH or watts); electric inputs (watts, voltage, phase and entering air temperature).
3. Enclosures:
 - a. General: Provide enclosures braced and reinforced to provide required stiffness, with adjustable heating element supports and brackets. Phosphastize and paint enclosures inside and out with single coat of gray, baked-on primer. Include air grilles in enclosure, die formed with fixed directional louvers. Provide removable front panels. Fabricate from 16-gage galvanized steel.
4. Temperature Controls:
 - a. Provide manufacturer's standard factory-installed temperature control packages.
 - b. Gaskets: Provide gaskets for installation between wall and enclosure of manufacturer's standard gasket material.
 - c. Accessories: Provide manufacturer's standard accessories of the following types; manufacturer's option applies where more than one type is indicated for each accessory:
 - 1) Access doors with tamper-proof latches. Where doors are located in grille areas, match grille.
 - 2) 18-gage galvanized steel back panel and/or sill extensions.
 - 3) Inlet grilles to match outlet grilles.
 - 4) Removable outlet grilles (top outlet units only).
 - 5) Inside corners, outside corners, end caps, and extensions of galvanized steel, same gage thickness as enclosures.
 - 6) Junction boxes.
 - 7) Built-in relays.
 - 8) Built-in thermostat with external adjustment.
 - d. Enclosure Finishes: Provide factory finishes of the following type:
 - 1) Baked enamel finishes selected from manufacturer's standard colors.
5. Manufacturers: Subject to compliance with requirements, provide electric finned-tube radiation of one of the following:
 - a. Qmark.
 - b. Berko Electric Mfg. Div.; Weil-McLain Co. Inc.
 - c. Trane Company.

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- E. General: refer to HVAC Control Drawings for terminal heating equipment control requirements.

2.18 POWER AND GRAVITY VENTILATORS (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. General: Except as otherwise indicated, provide standard prefabricated power and gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation. Refer to HVAC control drawings for control and ATC/BMS integration requirements.
- B. Refer to Division 23 automatic temperature control for control sequence.
- C. Roof Fans (EF)
1. Type: Centrifugal fan, direct or belt driven as scheduled. Provide aluminum, or galvanized steel, weatherproof housings as scheduled. Provide square base to suit roof curb. Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.
 2. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.
 3. Bird Screens: Provide removable bird screens, ½ in. mesh, 16-ga. aluminum or brass wire.
 4. Motor Operated Dampers: Provide louvered dampers with linkage below curb base (maximum of 6 in.). Provide hinged curb access with restraint cable for service.
 5. Finish: Provide two coat 70 percent Kynar/Hylar finish in color selected by Architect. Dry film thickness shall be 1.23 mil. Provide 10 year finish warranty. Submit color selection chart to Architect as part of submittal package.
 6. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
 - a. Greenheck Fan Corp.
 - b. Cook Co., Loren.
 - c. Twin City
 - d. Or equal
- D. Kitchen Exhaust Fans – Belt Drive Roof Upblast Centrifugal
1. General Description:
 - a. Discharge air directly away from the mounting surface.
 - b. Upblast fan shall be for roof mounted applications.
 - c. Performance capabilities up to 30,000 cubic feet per minute (cfm) and static pressure to 5 inches of water gauge.
 - d. Maximum continuous operating temperature is 400 Fahrenheit (204.4 Celsius).
 - e. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

2. Wheel:
 - a. Material Type: Aluminum.
 - b. Non-overloading, backward inclined centrifugal wheel.
 - c. Statically and dynamically balanced in accordance to AMCA Standard 204-05.
 - d. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency.
3. Motors:
 - a. AC Induction Motor
 - 1) Motor Enclosure: Open drip proof (ODP) - opening in the frame body and or end brackets.
 - 2) Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - 3) Mounted on vibration isolators, out of the airstream.
 - 4) For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.
 - 5) Accessible for maintenance.
 - 6) Provide premium efficiency inverted duty motors for VFD applications (where applicable, refer to schedule and control drawings).
4. Shaft and Bearings:
 - a. Fan Shaft shall be ground and polished solid steel with an anti-corrosive coating.
 - b. Permanently sealed bearings or pillow block ball bearings.
 - c. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - d. Bearings are 100 percent factory tested.
 - e. Fan Shaft first critical speed is at least 25 percent over maximum operating speed.
5. Housing:
 - a. Constructed of heavy gauge aluminum includes exterior housing, curb cap, windband, and motor compartment housing. Galvanized material is not acceptable.
 - b. Housing shall have a rigid internal support structure.
 - c. Windband to be one piece uniquely spun aluminum construction and maintain original material thickness throughout the housing.
 - d. Windband to include an integral rolled bead for strength.
 - e. Curb cap base to be fully welded to windband to ensure a leak proof construction. Tack welding, bolting, and caulking are not acceptable.
 - f. Curb cap to have integral deep spun inlet venturi and pre-punched mounting holes to ensure correct attachment to curb.

- g. Drive frame assemblies shall be constructed of heavy gauge steel and mounted on vibration isolators.
 - h. Breather tube shall be 10 square inches in size for fresh air motor cooling, and designed to allow wiring to be run through it.
 - 6. Vibration Isolation:
 - a. Double studded or pedestal style true isolators.
 - b. No metal to metal contact.
 - c. Sized to match the weight of each fan.
 - 7. Disconnect Switches:
 - a. NEMA rated: NEMA 1: indoor application no water. Factory standard.
 - b. Positive electrical shut-off.
 - c. Wired from fan motor to junction box installed within motor compartment.
 - 8. Drive Assembly:
 - a. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
 - b. Belt: Static free and oil resistant.
 - c. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
 - d. Motor pulleys are adjustable for final system balancing.
 - e. Readily accessible for maintenance.
 - 9. Drain Trough:
 - a. Allows for one-point drainage of water, grease, and other residues.
 - 10. Mounting Plate:
 - a. Attached and sealed to the wall prior to installation of unit.
 - 11. Options/Accessories:
 - a. Auto Belt Tensioner:
 - b. Automatic tensioning device that adjusts for the correct belt tension, only for single drives.
 - 12. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
 - a. Carnes Co., Div. of Wehr Corp.
 - b. Cook Co., Loren.
 - c. Greenheck Fan Corp.
 - d. Penn Ventilator Co., Inc.
 - e. Power Line Fans; Div. of Torin Corp.
 - f. Twin City
 - g. Or equal
- E. Centrifugal In-Line Fans (EF)
 - 1. General: Fans shall be of the centrifugal belt or direct driven in-line type. Units shall bear AMCA label.

2. Fan Housing: Shall be of the square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars. Unit shall include two removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components.
 3. Fan Wheel: Shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.
 4. Motors: Shall be heavy duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure. Motors and drives shall be mounted out of the airstream. Motors shall be readily accessible for maintenance.
 5. Shafts and Drives: Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be selected for a minimum (L50) life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150 percent of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing. A NEMA 1 disconnect switch shall be provided, factory wired.
 6. Manufacturer: Subject to compliance with requirements, provide centrifugal in-line fans of one of the following:
 - a. Greenheck Fan Corp.
 - b. Carnes CO., Div. of Wehr Corp.
 - c. Cook Co., Loren.
 - d. Penn Ventilator Co., Inc.
 - e. Power Line Fans; Div. of Torin Corp.
 - f. Or Equal.
- F. Prefabricated Roof Curbs
1. Manufacturer of ventilating unit shall provide his standard 18 in. high roof curb compatible with unit being provided. Curb shall be insulated with min 1" and sloped to allow for level installation of device. Provide all necessary nailers, and cants for a complete installation.
- G. Smoke Exhaust Fans
1. General: Fans shall be of the mixed flow belt or direct driven in-line type. Units shall bear AMCA label for sound and airflow performance, and shall be UL listed for smoke control exhaust system application.
 2. Fan Housing: Shall be of constructed of heavy gauge galvanized steel and shall include duct mounting collars. Unit shall include removable access panels located perpendicular to the motor mounting panel. The access panels must be of sufficient size to permit easy access to all interior components. Unit shall accommodate structural steel base mounting.

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3. Fan Wheel: Shall be mixed flow type, constructed of steel and shall include a wheel cone carefully matched to the inlet cone, spherical back plate and cambered blades for precise running tolerances. Wheels shall be statically and dynamically balanced to grade G6.3 per ANSI 52.19.
 4. Motors: Shall allow field rotatable motor position. Shall be heavy duty ball bearing type, carefully matched to the fan load and furnished at the specified voltage, phase, and enclosure. Motors and drives shall be mounted out of the airstream. Motors shall be readily accessible for maintenance. Minimum motor service factor shall be 1.15.
 5. Shafts and Drives: Precision ground and polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Bearings shall be heavy duty, grease lubricated self aligning ball or roller type selected for a minimum (L50) life in excess of 400,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. Motor pulleys shall be adjustable for final system balancing. A NEMA 1 disconnect switch shall be provided, factory wired. Belt type units shall be provided with 1.5 times the belts required.
 6. Finish: Provide two coat 70 percent Kynar/Hylar finish in color selected by Architect. Dry film thickness shall be 1.23 mil. Provide 10 year finish warranty. Submit color selection chart to Architect as part of submittal package.
 7. Manufacturer: Subject to compliance with requirements, provide centrifugal in-line fans of one of the following:
 - a. Greenheck Fan Corp.
 - b. Twin City
 - c. Cook Co., Loren.
 - d. Or equal

H. Laboratory Exhaust Fans

1. General
 - a. Base fan performance at standard conditions (density 0.075 Lb/ft³).
 - b. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15 percent of scheduled values.
 - c. Each fan shall be belt driven.
 - d. Fans to be equipped with lifting lugs.
 - e. Fan to be coated steel with a minimum of 4 mils of Hi-Pro Polyester Resin. Color to be gray.
 - f. Fasteners to be stainless steel.
 - g. Fan assembly shall be designed for a minimum of 125 MPH wind loading, without the use of guy wires. Where required by code or manufacturer, provide guy wires.
2. Corrosion Resistant Coating
 - a. All fan and system components (fan, nozzle, wind band, plenum) shall be corrosion resistant coated with LabCoat™, a two part electrostatically applied and baked, sustainable, corrosion resistant coating system; or Heresite P-413C. Finish color to be as selected by Architect.

- b. All parts shall be cleaned and chemically prepared for coating using a multi-stage wash system which includes acid pickling that removes oxide, increases surface area, and improves coating bond to the substrate.
 - c. The first powder coat applied over the prepared surface shall be a zinc rich epoxy primer (no less than 70 percent zinc) and heated to a gelatinous consistency (partial cure) at which the second powder coat of polyester resin shall be electrostatically applied and simultaneously be cured at a uniform temperature of 400 deg.F.
 - d. The coating system shall not be less than a total thickness of 6 mils, is not affected by the UV component of sunlight (does not chalk), and has superior corrosion resistance to acid, alkali, and solvents. Coating system shall exceed 4000 hour ASTM B117 Salt Spray Resistance.
 - e. Note that 10-20 mil thick wet coating systems pollute the environment (air and water), and that these manually applied coatings are not uniform over the impeller surface and can cause fan imbalance and vibration.
3. Fan Housing And Outlet
- a. Fan housing to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - b. Fan housing shall be welded steel with a minimum of 4 mils of Hi-Pro Polyester Resin. No uncoated metal fan parts shall be acceptable.
 - c. Fan housings that are fabricated of polypropylene or fiberglass that have lower mechanical properties than steel, have rough interior surfaces in which corrosive, hazardous compounds can collect, and / or which chalk and structurally degrade due to the UV component of the sunlight shall not be acceptable.
 - d. A high velocity conical discharge nozzle shall be supplied by the fan manufacturer and be designed to efficiently handle an outlet velocity of up to 6000 FPM. Discharge stack caps or hinged covers, impeding exhaust flow shall not be permitted.
 - e. Provide housing drain for removal of rain and condensation.
 - f. A bolted and gasketed access door shall be supplied in the fan housing allowing for impeller inspection or removal of impeller, shaft and bearings without removal of the fan housing.
 - g. Standard finish color to be gray.
4. Fan Impeller
- a. Fan impeller shall be centrifugal, backward inclined, with non-stall characteristics. The impeller shall be electronically balanced both statically and dynamically per AMCA Standard 204.
 - b. Fan impeller shall be manufactured of aluminum (AMCA type B spark resistant), fully welded and meet specification section 2.15 for corrosion resistant coating.
5. Fan Bypass Air Plenum
- a. For constant volume systems, the fan shall be connected directly to the exhaust duct without the need of a bypass air plenum.

- b. For variable volume systems, a bypass air plenum shall be provided. The plenum shall be equipped with a bypass air damper and intake air hood with bird screen for introducing outside air at roof level upstream of the fan.
 - c. The plenum shall be constructed of fully welded steel, meet specification section 2.15 for corrosion resistant coating, and mount on roof curb as shown on the project drawings. Plenums that are fabricated of plastics or resins that are combustible and have mechanical properties less than steel shall not be acceptable.
 - d. The bypass air plenum shall be mounted on factory fabricated roof curb provided by the fan manufacturer, as shown on the project drawings (see section 2.5)
 - e. Fan designs that use inlet flexible connectors that can leak causing loss of lab exhaust shall not be accepted.
 - f. Bypass air dampers shall be opposed-blade design, and coated with a minimum of 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked.
 - g. A fan isolation damper, either gravity back draft or two position actuated, fabricated of steel or aluminum and coated with minimum 4 mils of Hi-Pro Polyester resin, electrostatically applied and baked, shall be provided as shown on the project documents.
 - h. Blower / Plenum vibration isolation shall be limited to neoprene / cork vibration pads.
6. Bypass Air Plenum Curb
- a. Exhaust system manufacturer shall supply a structural support curb for the plenum, of specified height, as shown on the drawings.
 - b. Curb shall be fabricated of a minimum of 12 gauge corrosion resistant coated steel and structurally reinforced.
 - c. Curbs shall be insulated.
 - d. When properly anchored to the roof structure, the standard curb / plenum / blower assembly shall withstand wind loads of up to 125 mph without additional structural support.
7. Fan Motors And Drive
- a. Motors to be premium efficiency, standard NEMA frame, TEFC with a 1.15 service factor. A factory mounted NEMA 3R disconnect switch shall be provided for each fan. Motor maintenance shall be accomplished without fan impeller removal or requiring maintenance personnel to access the contaminated exhaust components.
 - b. Drive belts and sheaves shall be sized for 200 percent of the motor horsepower, and shall be readily and easily accessible for service, if required. Drive shall consist of a minimum of two belts under all circumstances.
 - c. Shaft to be polished and ground steel.

- d. Fan shaft bearings shall be Air Handling Quality, ball or roller pillow block type and be sized for an L-10 life of no less than 100,000 hours. Bearings shall be fixed to the fan shaft using concentric mounting locking collars, which reduce vibration, increase service life, and improve serviceability. Bearings that use set screws shall not be allowed.
 - e. All shaft bearings shall have extended lube lines with zerk fittings.
8. Installation
- a. Install fans with flexible electrical leads.
 - b. Pipe housing drain to nearest drain.
 - c. Install fans in accordance with manufacturer's instructions.
9. Acceptable Manufacturers
- a. Greenheck Fan Corp, Model Vektor High Plume Laboratory Exhaust System (as scheduled)
 - b. Strobic Air
 - c. MK Plastics
 - d. Approved equal.
- I. Penthouse Elevator Ventilator
- 1. Type: Penthouse style gravity ventilator with louvers on three sides and breakable glass on the remaining side. Vent shall be sized to comply with the Massachusetts Elevator Code.
 - 2. Smoke Damper: Provide a sheetmetal damper rated for smoke duty in the throat of the unit. The damper shall be rated for leakage Class 1. The actuator shall be 120V, fail open with open-closed indicator.
 - 3. Louvers: Louvers shall be heavy gauge extruded stationary louvers constructed of 6063-T5 aluminum of 0.081 in. thickness. Louver shall be 4 in. deep. Louvers shall have a removable bird screen panel mounted on the inside face of the louver. The aluminum bird screen shall be $\frac{3}{4}$ in. flattened, expanded mesh of 0.051 in. thickness.
 - 4. Glass: Glass panel shall be 0.125 in. thick annealed clear breakable glass.
 - 5. Hood: Hood shall be 38 in. x 38 in. x 18 in. high. Hood shall be constructed of 0.100 thick formed aluminum insulated with 0.5 in. duct liner with an anti-microbial coating.
 - 6. Curb: Curb shall be constructed of 12 gauge cold rolled steel of welded construction with a 4 in. mounting flange.
 - 7. Finish: Penthouse vent and curb to be provided with a two coat 70 percent Kynar/Hylar finish in color selected by Architect. Dry film thickness shall be 1.2 mil. Provide ten year finish warranty. Submit color selection chart to Architect as part of submittal package.
 - 8. Manufacturer: Subject to compliance with specifications herewithin, acceptable manufacturers include: Greenheck Model PEV-400 or equal.

2.19 METAL DUCTWORK (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. Reference Standards: Material, construction and installation shall meet requirements of most recent editions of the following standards and references, except for more stringent requirements specified or shown on Drawings:

Standard As Applicable To:

SMACNA HVAC Duct Sheet Metal Ductwork;
Construction Standards Duct Liners; Adhesives;
Metal and Flexible Fasteners; Flexible Ductwork.

SMACNA HVAC Air Duct Leakage Duct Leakage Testing
Test Manual

SMACNA Fibrous Glass Duct Fibrous Glass Ductwork; Tapes
Construction Standards

SMACNA Thermaoplastic Duct (PVC) PVC Ductwork
Construction Manual

ADC and TIMA Flexible Duct Flexible Ductwork
Performance Standards

NFPA 96 Kitchen Hood Exhaust Ductwork

NFPA 45 Laboratories using chemicals

SMACNA Guidelines for Welding Welded Galvanized, Black Iron
Sheet Metal and Stainless Steel Ductwork

IBC Section 909

- B. General

1. Provide supporting and hanging devices necessary to attach entire HVAC system including ductwork and equipment, and to prevent vibration.
2. Provide vertical and horizontal supports as required by codes to meet minimum applicable earthquake resistance standards.
3. Ductwork shall be free from vibration under all conditions of operation. Dimensions shown on Drawings for lined ductwork are net inside dimensions. Increase ductwork to accommodate lining requirements.
4. Pipe or conduit crossing duct:
 - a. No pipe, conduit, hanger, Architectural element nor structural member shall pass through duct without Designer's written approval.
 - b. Where it is impossible to re route pipe or conduit and when written approval has been obtained, increase duct size to maintain constant cross sectional area at point of interference. Provide streamlined enclosure for pipe or conduit, as illustrated in SMACNA.

5. When making offsets and transformations necessary to accommodate structural conditions, preserve full cross sectional area of ductwork shown on Drawings.
6. Ductwork shall have pressure velocity classifications as follow:

DUCT CONSTRUCTION CLASS	STATIC PRESSURE RATING	PRESSURE	SMACNA SEAL CLASS	SMACNA LEAKAGE CLASS	VELOCITY
6"	6"	Pos.*	A	3	4000 fpm or less
4"	4"	Pos.*	A	3	4000 fpm or less
3"	3"	Pos. or Neg.	A	3	4000 fpm or less
2"	2"	Pos. or Neg.	A	6	2500 fpm or less
1"	1"	Pos. or Neg.	A	6	2500 fpm or less
½"	½"	Pos. or Neg.	A	6	2000 fpm or less

*for negative pressures over 3" w.g., refer to SMACNA Round and Rectangular Industrial Duct Construction Standards for joint and intermediate reinforcement requirements.

- a. Unless otherwise specified or shown on the drawings, the following pressure classifications shall be used for the types of ductwork listed below:
 - 1) 6" Class: All smoke exhaust ductwork from fan inlet to intakes.
 - 2) 4" Class: All supply ductwork from discharge of rooftop units to inlets of displacement diffusers and duct mounted or ceiling mounted diffusers.
 - 3) 3" Class: All kitchen hood exhaust, all return ductwork, kiln exhaust, fume hood exhaust, welding booth exhaust, and chemical cabinet ductwork.
 - 4) 2" Class: All other ductwork.
7. Sealing Requirements for Class A, Leakage Class 3, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel Ductwork:
 - a. Transverse Joints
 - 1) During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures. After sealant has cured, seal entire joint with Hardcast Inc. RTA-50 adhesive on to Hardcast Inc. DT tape or approved equal.

- 2) Seal all non-flanged transverse joints with Hardcast Inc. RTA-50 adhesive on to Hardcast Inc. DT tape or approved equal.
 - b. Longitudinal Seams
 - 1) Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.
 - c. Joints and Ductwall Penetrations
 - 1) Seal all duct joints at takeoffs, access doors, damper bearing penetrations, flexible duct connections, seams, elbows, Tee's and any fitting with Hardcast Inc. Versa Grip 102 or approved equal.
 - 2) Note, access doors and damper rod penetrations shall be equipped with proper hardware for sealing.
8. Sealing Requirements for Class A, Leakage Class 6, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel Ductwork.
 - a. Transverse Joints
 - 1) During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
 - 2) Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip 102 or approved equal.
 - b. Longitudinal Seams
 - 1) Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.
 - c. Joints and Ductwall Penetrations
 - 1) Seal all duct joints at takeoffs, access doors, damper bearing penetrations, flexible duct connections, seams, elbows, Tee's and any fitting with Hardcast Inc. Versa Grip 102 or approved equal.
9. Sealing Requirements for Class B, Leakage Class 12, Galvanized, Non-Welded Aluminum or Non-Welded Stainless Steel, Ductwork.
 - a. Transverse Joints
 - 1) During assembly seal all flanged transverse joints with sealing tape of quality equal to Hardcast Inc. 1902-FR. Corners shall be sealed as described by SMACNA and when applicable per manufacturer's published procedures.
 - 2) Seal all non-flanged transverse joints with Hardcast Inc. Versa Grip 102 or approved equal.
 - b. Longitudinal Seams
 - 1) Seal all longitudinal seams during ductwork fabrication with Hardcast Inc. Cold Seal 1001 or approved equal.
10. Support
 - a. Space hangers as required by SMACNA (8 ft max) for horizontal duct on 8 ft. centers, unless concentrated loadings require closer spacing.
 - b. Support vertical duct on each floor or slab it penetrates.

- c. Supports for ductwork and equipment shall be galvanized unless specified otherwise.
11. Connections
- a. Connect inlets and outlets of air handling units and fans to ductwork with flexible connections unless fan has vibration isolator mounts inside unit with flexible connections and no external vibration isolators. Exception: Do not use flex on life safety smoke exhaust fans.
 - b. Indoors, flexible connections shall be neoprene coated fibrous glass fire retardant fabric, by Ventfabrics, or Durodyne. Outdoors, flexible connections shall be Dupont hypalon coated fibrous glass fire, weather, and UV resistant by Ventfabrics or Durodyne.
 - c. Secure flexible connections tightly to air handlers with metal bands. Bands shall be same material as duct construction.
 - d. Connections from trunk to branch ducts shall be as detailed on Drawings.
12. Construction
- a. No sharp metal edges shall extend into air streams.
 - b. Install drive slips on air leaving side of duct with sheet metal screws on 6" centers.
 - c. Spin in collars shall NOT be used for branch connections in 3" or higher pressure class ductwork.
13. Joints
- a. Longitudinal lock seams shall be double locked and flattened to make tight joints.
 - b. Make transverse joints, field connections, collar attachments and flexible connections to ducts and equipment with sheet metal screws or bolts and nuts. Do not use rivets and staples.
14. Prefabricated Transverse Duct Joints
- a. Transverse joints in galvanized sheet metal ductwork may be made with galvanized gasketed frame and angle duct joint system by Ductmate, TDF, TDC or approved equal. Angles shall be at least 20 gauge. Prefabricated transverse duct joints shall not be used for duct 16 GA. and heavier, nor for duct 23 GA. or lighter.
 - b. Secure angles to duct with screws (using clutched arbor) or spot welds spaced as recommended by manufacturer for duct pressure class.
15. Elbows and Bends
- a. Elbows and bends for rectangular ducts shall have centerline radius of 1 1/2 times duct width wherever possible. Elbows for grease exhaust and fume hood exhaust shall be full radius. Vanes or mitered duct are not allowed.
 - b. Where centerline radius is less than 1 1/2 times duct width (on supply, return and exhaust ductwork), elbows shall be radius throat (square throat allowed when turning around column or other close objects) with radius heel. For elbows whose width is greater than 48 inches and/or where shown on plans, provide splitter vanes. Install vanes in accordance with SMACNA. Where multiple elbows are separated by less than ten duct diameters use splitter (full length) vanes.

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- c. For round ductwork provide stamped elbows, with centerline radii equal to 1 1/2 times duct diameter, or gored elbows as follows:

Elbow Angle	No. of Gores
0° - 36°	2
37° - 72°	3
73° - 90°	5

- d. Elbows for flat oval ducts shall have centerline radii equal to 1 1/2 times duct diameter in plane of bend, or gored elbows with gores as specified for round ducts.

16. Access Panels/Doors

- a. Provide proper pressure and leakage rated, gasketed, duct mounted access panels/doors for the following items with minimum sizes, as indicated. Access doors shall be of double wall construction doors in insulated ducts shall be insulated. Gauges of door materials, no. of hinges, no. and type of door locks shall be as required by the SMACNA Duct Construction Standards. Hinged doors are not acceptable, screwed or bolted access panels are not acceptable. Doors shall be chained to frame with a minimum length of 6" to prevent loss of door. For seal Class A, access doors shall be leakage rated, neoprene gasketed UL 94 HF1 listed, DUCTMATE "sandwich" or approved equal. Door metal shall be the same as the attached duct material. For grease and high temperature ducts, door assembly shall be rated for 2300°F. The minimum sizes are:

- 1) Fire dampers 12" x 12", or larger.
- 2) Combination Fire/Smoke dampers 12" x 12", or larger.
- 3) Smoke dampers 6" x 6" minimum.
- 4) Automatic control dampers 6" x 6" minimum.
- 5) Manual volume dampers 2 sq. ft. and larger 6" x 6" minimum.
- 6) Inlet side to all coils 12" x 12", or larger.
- 7) Suction and discharge sides of inline fans 24" x 24" minimum.
- 8) At additional locations indicated on drawings, or specified elsewhere 12" x 12" minimum.

- b. Generally access doors are not shown on the drawings, but shall be provided in accordance with the above.

17. Extractors shall have adjusting rod and locknut on outside of duct.

18. Connections to roof fans:

- a. Shall be at least 22 ga. galvanized steel soldered watertight.
- b. Solder side seams at least 12" up from bottom.
- c. Provide suitable dielectric gaskets to join dissimilar materials.

19. Plenums and connections to louvers:

- a. Shall be 18 ga. minimum cross broken and properly reinforced with galvanized angle irons to SMACNA requirements.

- b. Shall have bottom and corner seams soldered watertight at least 12" up from bottom.
 - c. Shall have neoprene gaskets or other non corrosible material to make connections to louvers watertight.
 - d. Shall pitch connection back towards the louver. Provide half coupling drain connection at bottom of plenum unless noted otherwise Pipe drain to nearest floor drain.
 - e. Shall have unused portions of louvers blocked-off with sheet metal; sealed air and water tight; insulated with 2" thick 6 lb. density rigid or board insulation.
20. Duct Pressure Tests
- a. Pressure test all duct classes after takeoffs and wall penetrations are in place and before applying exterior insulation. Correct any leaks.
 - b. Pressure and leak test 100% of all duct work with a pressure class of 3" or higher as specified in paragraph 2.18.B.7.a. Duct shall be constructed so there is no joint or structural failure at the test pressure.
21. Duct Leakage Tests
- a. Leak testing method shall be performed as outlined in the SMACNA HVAC Air Duct Leakage Test Manual. As specified in paragraph 2.17.B.7 & a, utilize Sealing Requirements for Class A and Leakage Class 6. Provide orifice assembly including straightening vanes, orifice plate mounted in straight tube with properly located pressure taps, and U tube manometer or other device as specified by SMACNA. Orifice assembly shall be calibrated accurately and shall come with calibration curve. Leakage classes shall be as previously specified. Submit leak test report (per SMACNA format) for Designer review. Drawings of ductwork tested shall also be submitted with report, indicating presence of takeoffs, wall penetrations, joints, etc.
22. Materials
- a. Sheet metal ducts shall be constructed of hot dipped galvanized sheet metal with G90 Commercial coating according to ASTM 527 unless specified otherwise.
 - b. Stainless steel (SS) ductwork shall be 18 gauge for exposed ductwork serving kitchen hoods and for all Science Classroom fume hood exhaust ductwork; and as required by SMACNA for other ducts. Materials shall be 316/No. 4 finish for exposed duct, 304/No. 1 finish for concealed ducts. Joints and seams shall be welded as required by SMACNA Guidelines for Welding Sheetmetal.
 - c. Aluminum ductwork for dishwashers, toilet rooms with showers, shower areas and locker rooms shall be Alclad 3003 1414 or alloy 5052 H32, of thickness required by the SMACNA duct construction standards with Alloy 6061 bracing angles, and Pittsburgh lock longitudinal corner and double side seaming. Pitch ductwork back to dishwasher/grilles. For this ductwork, seal Class A shall be utilized regardless of pressure class.
 - d. Kitchen exhaust ductwork located above ceilings shall be constructed of 16 gauge black iron steel and constructed in accordance with IMC 2015 and NFPA 96 requirements.

e. Flexible Ductwork

- 1) Flexible ductwork, connecting to uninsulated or unlined duct, shall be polyester core with corrosion resistant helical wire reinforcing. The polyester core shall be minimum two ply and shall have a minimum thickness of 0.0017". Flex duct shall be U.L. rated for 6" W.C. positive pressure, 2" W.C. negative pressure with a maximum velocity of 4000 FPM. Flexduct must be listed as a Class 1 Connector according to UL 181 and shall meet the requirements of NFPA 90A maximum ASTM E 84 fire hazard rating shall be 25 flame spread, 50 fuel contributed and 50 smoke developed. Uninsulated flexible duct shall be equivalent to Wiremold, Type WB, or Flexmaster Types 2 and 4 (not type 9).
 - 2) Flexible duct connected to insulated or lined duct shall also be insulated and shall be equivalent to Wiremold Type WK or Flexmaster Types 2 or 4 (not type 9), with 1 1/2", 3/4 lb. density fiberglass insulation and an aluminized reinforced vapor barrier.
 - 3) Submittals shall include data on no. of polyester plies and minimum thickness of polyester core, in addition to other data listed above required to ensure that submitted product meets the requirements of these specifications.
 - 4) If flexduct other than the model numbers of the vendors listed above is submitted, a sample of the flex shall be submitted to the Designer. The Designer shall have sole discretion in determining whether the submitted flex is equivalent to that of the named vendors above.
 - 5) Unless otherwise indicated, flexible duct shall not exceed 5'-0" long.
- f. Rigid PVC ductwork shall be thermally formed ASTM D 1784 69 Class 12454 B with 3/16" thick wall.

C. 2" and Lower Pressure Class Ductwork, Rectangular:

1. Ducts wider than 19" with more than 10 square feet of unbraced panel shall be beaded or cross broken.
2. Internal stiffening struts shall only be used upon prior written approval of the Designer.
3. Make changes in duct size with tapered connections as required by SMACNA. Changes shall NOT exceed 30° from line of air flow. Take off to the diffusers shall be 45° leading edge type or Bellmouth type.
4. Transverse joints shall be TDF/TDC or slip joints; use flat or standing seam according to SMACNA. Where duct size requires standing seam but space restrictions dictate flat seam, notify Designer prior to fabrication.

D. 2" and Lower Pressure Class Ductwork, Round:

1. Joints
 - a. Longitudinal joints shall be spiral seam, butt welded, lap and seam welded, or ACME lock grooved seam. Snap lock seams shall be used on 1/2" w.g. pressure class duct only.
 - b. Transverse joints shall be beaded sleeve joint or other approved joints listed in SMACNA. Use three or more sheet metal screws at 15" uniform intervals along circumference of joints.

2. Branch fittings shall be conical tee (Buckley or equal) or combination tee as shown in SMACNA.
- E. 3" and 4" Pressure Class Ductwork Rectangular
1. Joints
 - a. Joints shall be prefabricated type by TDC, TDF or Ductmate. See Prefabricated Joints paragraph for specific requirements.
 2. Duct reinforcement spacing and type shall comply with SMACNA.
 3. Ductwork on both sides of transitions shall be run in same horizontal axis.
 4. Diverging section slope shall be 1 1/2" per foot or less if possible.
 5. Contraction section slope shall not exceed 7" per foot.
 6. Takeoffs shall be 45° leading edge type except that Bellmouths (Buckley or equal) may be used for takeoffs to terminal boxes if the distance between the box and point of takeoff is less than 8 ft.
 7. Ducts with an aspect ratio greater than 3:1 shall be minimum of 18 gauge unless a thicker gauge is required by SMACNA.
- F. 3" and 4" Pressure Class Ductwork, Flat Oval, Single Wall
1. Joints
 - a. Ducts shall have spiral lock seams or longitudinal seams. Seams and joints in fittings shall be continuously welded. If coating is damaged during welding, repair joints to prevent corrosion.
 - b. Transverse joints shall be slip or flanged.
- G. 3" and 4" Pressure Class Ductwork, Round, Single Wall
1. Joints
 - a. Longitudinal seams shall be lock spiral, lock longitudinal or butt welded longitudinal.
 - b. Transverse joints shall be slip joints. Draw band joints shall be used on longitudinal seam duct only. Loose flange Vanstone joints may be used on ducts over 36" in diameter.
 - c. Seams and joints in fittings shall be continuously welded. If coating is damaged during welding, repair joints to prevent corrosion.
 2. Branch fittings shall be conical tee or combination tee as detailed in SMACNA.
- H. Double Wall Ductwork
1. Duct and fitting shall be United Sheet Metal Co., Acousti K27, type P or equal consisting of:
 - a. External pressure tight shell of zinc coated steel.
 - b. Uniformly packed, 1-1/2" layer of fire resistant fibrous glass acoustic insulation with R-6 value with mylar or foil liner meeting 25/50 flame spread/smoke developed rating.
 - c. Internal perforated protective metal liner of zinc coated steel, with holes sized and spaced to give acoustic impedance of noise reduction characteristic of Acousti K27 duct.

2. Pressure shell of round duct shall be United or approved equal spiral pipe and pressure shell of fittings shall be zinc coated steel, as follows:

Item	Size	Gauge of Pressure Shell
Duct	3" to 6"	26
	7" to 20"	24
	21" to 34"	22
	36" to 48"	20
Fitting	3" to 34"	20
	36" to 48"	18

3. Fittings shall be continuous, corrosion resistant welds made by certified welders.
4. Joints between straight duct sections shall be made with pre fabricated couplings with 4" shoulder inserted into duct.

I. Flexible Rigid Duct

1. Flexible ductwork shall be Flexmaster Triple Lock Buck Duct Flexible Air Duct (insulated) as manufactured by Buckley Associates or equal (617 878 5000). Flexible duct, non insulated, shall be Underwriters Laboratory Listed UL 181 Class 0 air duct and constructed in accordance with NFPA Standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.
2. Duct shall be made from a tape of dead soft aluminum sheet, spiral wound into a tube and spiral corrugated to provide strength and stability. The joint shall consist of a triple lock mechanically performed without the use of adhesives to make a durable airtight seam. A double lock is not acceptable.
3. Flexible duct connected to insulated or lined duct shall also be insulated. Flexmaster insulated flex shall have a gray Fire Retardant Polyethylene outer jacket with a ½ lb. density, 1 1/2" thick fiberglass insulation blanket, factory wrapped. Flexible Duct, insulated, shall be Underwriters Laboratory Listed and constructed in accordance with NFPA standards 90A and 90B. It shall have a smoke/flame spread rating of 50/25.
4. The flexible duct shall be supported as required.
5. Flexible duct work shall be rated at 12" positive pressure. Duct from 3 to 16" shall have a negative pressure of 12", 8" for duct work 18 and 20.
6. All flexible duct shall be individually cartoned and labeled for delivery to the job site for maximum protection.
7. Submittals shall include data on minimum thickness of aluminum core, in addition to other data listed above, required to ensure that submitted product meets the requirements of these specifications.
8. Provide sealing compound for installation. See further paragraphs in this specification and details for other installation requirements.

- J. Thermoplastic Ductwork (PVC)
1. PVC duct installation shall be as recommended by SMACNA Thermoplastic (PVC) Duct Construction Manual.
 2. Butt weld longitudinal and transverse joints with hot gas filter rod welding. Rods shall be compatible with material specified for duct. Stagger longitudinal seams. Weld transverse seams on 8 foot centers.
 3. Taper transition pieces 5" in length for each 1" change in diameter.
 4. Provide welded 4" wide reinforcing sleeve straps where recommended by SMACNA.
 5. Provide expansion joints where recommended and as specified by SMACNA.
 6. Provide suitable hangers and supports on eight foot centers that coincide with transverse joints as recommended by SMACNA.
- K. Volume Dampers
1. Provide Young Regulator manual adjustable rectangular opposed blade dampers for duct heights less than 12" with factory installed locking hand quadrants extended 2" for all dampers installed in externally insulated duct:
 - a. On each supply, return and general exhaust duct take off.
 - b. At each take off to register, grille or diffuser (not all are shown on Drawing).
 2. Dampers are manufactured approximately 5/16" smaller in width and 1/8" smaller in height than size of duct in which they are installed; e.g., nominal damper size is 24" x 10"; actual size is approximately 23 11/16" x 9 7/8".
 3. Damper frame shall be constructed of #6063 extruded aluminum reinforced channel with minimum thickness of .050". Opposed damper blades shall be #6063 extruded aluminum with minimum thickness of .050" and shall include reinforcing ribs. Each blade shall be supported in the damper frame by individual Teflon axle bearings, and shall be driven by stainless steel connecting slide linkage controlled by 3/8" square steel control shaft.
 4. Note: All required volume dampers may not be indicated on drawings but dampers shall be provided as necessary for systems balancing.
 5. Dampers 12" and larger in height shall be opposed multi blade equal to Greenheck, Nailor, or Vent Products.
 6. Where dampers are inaccessible, use Young Regulator locking type ceiling regulators and miter gear or worm gear for all horizontal dampers. Bearing coupling for bottom duct control may be used for shaft on vertical blade dampers. The 3/8" rod between ceiling regulator and damper shall be provided by contractor.
 7. Damper blades shall be two gauges heavier than adjoining ductwork, and shall be riveted to supporting rods. Hem over edges parallel to rods.
 8. Brackets shall be galvanized metal, secured to ductwork with sheet metal screw with locking quadrant arms (see seal class section for additional requirements). Provide 2" handle extension for all dampers on externally insulated ductwork.
 9. Note: All required volume dampers may not be indicated on Drawings but dampers shall be provided as necessary for system balancing.

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- L. Automatic Dampers: Install automatic dampers furnished under Automatic Temperature Control Paragraph of this Section, as shown on Drawings, and as specified. Provide sealed wall penetrations for Seal Class A ductwork.
- M. Branch Duct Take off Fittings
1. Contractor shall provide Buckley Bellmouth Take offs at all branch duct locations.
 2. Bellmouth Fitting shall be Model BMD with damper. In areas where sufficient duct height is not available, the contractor shall provide the Buckley Mini mouth fitting, Model M BMD with damper or the flat oval Bellmouth, Model FOBMD with damper.
 3. Bellmouths shall be constructed of heavy duty galvanized steel. Bellmouths shall include an air tight Neoprene gasket to ensure a tight fitting with minimal leakage. Pre drilled holes shall be provided for quick mounting. Bellmouth shall be as manufactured by Buckley Associates or equal (617 878 5000).
 4. Standard damper hardware to be constructed of 26 gauge galvanized material with a quadrant damper and tight fitting gasketing to ensure minimal leakage at damper pivot points.
 5. Optional heavy duty hardware shall be provided at locations of higher static pressure where shown on the drawings.
 6. Ninety degree take offs are not permitted on this project.
- N. Exterior Ductwork System
1. Manufacturers
 - a. Q Duct by AQC Industries is Basis of Design.
 - b. Kingspan Kool Duct
 - c. Thermaduct
 - d. Or equal
 2. Outdoor, Pre-Insulated Duct System
 - a. Exterior Ductwork is to be a double layered duct system using prefabricated phenolic duct panels and assembled into inter-locking sections. Exterior ductwork shall be provided as:
 - b. 2.5" thick: R-12
 - c. The panels used in the fabrication of the ductwork system shall be rigid Phenolic insulation panels with a thermal conductivity of 0.1977 BTU-in/hr•ft² °F and a minimum compressive strength of 29 psi.
 - d. Rigid Phenolic insulation panels shall comprise a 3.4–3.75 pcf nominal density CFC/HCFC–free rigid Phenolic insulation core with zero Ozone Depletion Potential (ODP), autohesively bonded on both sides: 60 micron aluminum internal liner and a 200 micron aluminum external liner. Both liners are to be solid aluminum with no perforations.
 - e. All other components required for the fabrication of the pre-insulated duct system shall be from the rigid panel System guidelines including the sealant, contact adhesive, aluminum tape, self–adhesive gasket, ductwork reinforcements, closures, connectors and flanges or alternate as approved / supplied by AQC Industries.

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- f. Exterior cladding shall be 5 ply, puncture resistant, tear resistant, flexible, and meet UL1709.
3. FIRE AND SMOKE PERFORMANCE
- a. The rigid Phenolic insulation panels used in the fabrication of the pre-insulated duct system shall be from the Rigid Panel Duct System manufacturer and shall achieve the following fire and smoke performance requirements:
 - 1) ASTM E 84—low contribution to fire growth not exceeding 25 Flame Spread and 50 Smoke Developed indices;
 - 2) UL 723 —low contribution to fire growth not exceeding 25 Flame Spread and 50 Smoke Developed indices; and
 - 3) UL 181 – UL/ULC classification as a Class 1 Air Duct to NFPA Standards 90A & 90B.
4. SEALANT MATERIALS
- a. All internal seams must be fully sealed with an unbroken layer of Phenolic sealant.
 - b. Each ductwork section must be duly connected with an inter-locking, double sealed jointing system. Sufficient sealant should be applied to each layer in order to seal the rigid Phenolic insulation panels and ensure minimum air leakage.
 - c. Ductwork reinforcement, if necessary, shall be applied to protect against side deformation from both positive and negative pressure.
 - d. All external seams where two separate panels join must be tiger clipped, taped and jacketed in watershed fashion whenever possible to achieve a permanent bond with weather protection and a smooth appearance.
- 2.20 DUCTWORK ACCESSORIES (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)
- A. Dampers:
- 1. Low Pressure Manual Dampers: Provide dampers of single blade type or multi-blade type, constructed in accordance with SMACNA "HVAC Duct construction Standards".
 - 2. Automatic Control Dampers: Refer to Division 23 section "Automatic Temperature Control" for control dampers; not work of this section.
 - 3. Backdraft Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at .05 in. static pressure. Construct blades of 16-ga. aluminum; provide ½ in. diameter ball bearings, 1/2 in. diameter steel axles spaced on 9 in. centers. Construct from 2 in. x 1/2 in. x 1/8 in. steel channel for face areas 25 sq. ft. and under: 4 in. x 1-1/4 in. x 16 ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up. Provide felted or rubber trim to assure tight, leak-proof seal when closed.
 - 4. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
 - a. Air Balance, Inc.
 - b. Airgarde Corp.

- c. American Warming & Ventilating, Inc.
- d. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
- e. Louvers & Dampers, Inc.
- f. Penn Ventilator Co.
- g. Ruskin Mfg. Co.
- h. Or Equal.

B. Fire Dampers:

1. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga. galvanized steel. Provide fusible link rated at 160 to 165 degrees F (71 to 74 degrees C) unless otherwise indicated. Provide out of air stream type damper in open position and with positive lock in closed position with stainless steel heat treated type 301 closure spring, and with the following additional features:
 - a. Damper Blade Assembly: Curtain type.
 - b. Blade Material: Steel, match casing.
 - c. Blade Material: Stainless steel.
2. Combination Fire/Smoke Dampers: Provide fire/smoke dampers, of types and sizes indicated. Construct casing of 11-ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160 to 165 degrees F (71 to 74 degrees C) unless otherwise indicated. Provide additional frangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36 in. long wire leads for connecting smoke link to smoke detector, and the following additional features:
 - a. Damper Blade Assembly: Single-blade type.
 - b. Damper Blade Assembly: Multi-blade type.
 - c. Damper Blade Assembly: Curtain type.
 - d. Blade Material: Steel, matching casing.
 - e. Blade material: Stainless steel.
3. Motor-Driven Fire/Smoke Dampers: Provide motor-driven fire/smoke dampers in types and sizes indicated, with casing constructed of 11-ga. galvanized steel with bonded red acrylic enamel finish, fusible link 160 to 165 degrees F (71 to 74 degrees C), unless otherwise indicated, and curtain type stainless steel interlocking blades, with electric motor equipped with instant closure clutch, stainless steel cable damper blade linkage, motor mounting bracket, and 32 in. long wire leads for connecting to smoke detector, and with the following construction features:
 - a. Unit Assembly: Motor mounted outside air stream.
4. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
 - a. Air Balance, Inc.
 - b. American Warming & Ventilating, Inc.
 - c. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.

- d. Louvers & Dampers, Inc.
 - e. Penn Ventilator Co.
 - f. Phillips-Aires
 - g. Ruskin Mfg. Co.
 - h. Or Equal.
- C. Turning Vanes:
- 1. Manufactured Turning Vanes: Provide double thickness airfoil turning vanes constructed of 1-1/2 in. wide curved blades set at $\frac{3}{4}$ in. o.c., supported with bars perpendicular to blades set at 2 in. o.c, and set into side strips suitable for mounting in ductwork.
 - 2. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
 - a. Aero Dyne Co.
 - b. Airsan Corp.
 - c. Anemostat Products Div.; Dynamics Corp. of America.
 - d. Barber-Colman Co.
 - e. Duro Dyne Corp.
 - f. Environmental Elements Corp.; Subs, Koppers Co., Inc.
 - g. Hart & Cooley Mfg. Co.
 - h. Register & Grille Mfg. Co., Inc.
 - i. Southern, Inc.
 - j. Or Equal.
- D. Duct Hardware:
- 1. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 - a. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 - b. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 in.. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
 - 2. Manufacturer: Subject to compliance with requirements. Provide duct hardware of one of the following:
 - a. Ventfabrics, Inc.
 - b. Young Regulator Co.
 - c. Or Equal.
- E. Duct Access Doors:
- 1. General: Provide duct access doors of a size as required to service and maintain device in duct. All access doors to be a minimum of 12 in.x12 in. and to be gasketed and installed air tight. Provide one access door at each control damper, humidifier, coil, fire damper, and any device that requires attention.

2. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12 in. high and smaller, 2 handle-type latches for larger doors.
3. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
 - a. Air Balance, Inc.
 - b. Duro Dyne Corp.
 - c. Register & Grille Mfg. Co., Inc.
 - d. Ruskin Mfg. Co.
 - e. Ventfabrics, Inc.
 - f. Zurn Industries, Inc.; Air Systems Div.
 - g. Or Equal.

F. Flexible Connectors:

1. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment.
2. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
 - a. American/Elgen Co.; Energy Div.
 - b. Duro Dyne Corp.
 - c. Flexaust (The) Co.
 - d. Ventfabrics, Inc.
 - e. Or Equal.

2.21 FABRIC DUCT

A. TEXTILE AIR DISPERSION SYSTEM:

1. Air diffusers shall be constructed with internal frame.
 - a. Textile components supported solely by metal cylindrical rings.
 - b. Each cylindrical ring shall require a vertical metal to metal cable safety attachment.
 - 1) Vertical supports are Galvanized steel with available lengths of 5'(standard), 10', 15', & 30'.
 - c. Available for diameters from 8" – 84".
 - d.

B. TEXTILE MATERIAL

1. TufTex or equal

- a. Textile Construction: Filament/filament twill polyester, fire retardant in accordance with UL 2518.
 - b. Air Permeability: 2 (+2/-1) CFM/ft² per ASTM D737, Frazier
 - c. Weight: 6.8 oz. /yd² per ASTM D3776
 - d. Warranty: 15 years with standard inlet velocity.
2. Textile Color
- a. Standard: blue, white, tan, red, green, silver, black; as approved by Architect. Provide color sample with shop drawing submittal.

C. TEXTILE SYSTEM FABRICATION REQUIREMENTS:

1. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps, and mid-sections) and top access zippers for vertical cable safety attachment.
2. Integrated air dispersion shall be specified and approved by manufacturer.
 - a. Linear Vents
 - 1) Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
 - 2) Size of vent openings and location of linear vents to be specified and approved by manufacturer.
3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via. zip screw fastener – supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required intermediate zippers as specified by manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

D. DESIGN PARAMETERS:

1. Textile air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
2. Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
3. System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
4. Do not use textile diffusers in concealed locations.

5. Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

E. QUALITY ASSURANCE:

1. Building Codes and Standards:
 - a. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread / smoke developed requirements of NFPA 90-A and UL 2518. Also Classified by UL-C (Canada) S102.2, BS 5867 Part 2, 1980; GB8624-2006.
 - b. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
2. Design & Quality Control
 - a. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

F. WARRANTY:

1. Manufacturer must provide a 15 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

G. MANUFACTURER:

1. Subject to compliance with requirements, choose one of the following:
 - a. DuctSox® Corporation
 - b. FabricAir
 - c. KE Fibretec
 - d. Or equal

2.22 ACOUSTIC DUCT LINING

- A. Lining for Rectangular Metal Ducts: All ducts, where shown or noted on the drawings, shall be lined with 1 ½ in. thick (R-6 min. performance) liner similar to Johns Manville "Linacoustic RC" fiberglass duct liner with factory-applied surface and edge coating. The liner shall meet the Life Safety Standards as established by NFPA 90A and 90B, FHC 25/50 and Limited Combustibility and the airstream surface coating should contain an immobilized, EPA-registered, anti-microbial agent so it will not support microbial growth as tested in accordance with ASTM G21 and G22. The duct liner shall conform to the requirements of ASTM C 1071 and C1104, with an NRC not less than .75 as tested per ASTM C 423 using a Type "A" mounting, and a thermal conductivity no higher than .24 at 75EF mean temperature.
- B. Material Handling and Storage: Liner shall be kept clean and dry during transportation, storage and installation. Care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.
- C. Manufacturer: Subject to compliance with the above provide duct sound lining in accordance with the above performance criteria description.

2.23 SOUND ATTENUATORS (SA)

- A. General: Provide factory-fabricated and tested duct silencers as indicated, select with performance characteristics which match, or exceed those indicated on schedule.
- B. Casings: Construct of sheet metal, with gage and seam construction equal or greater than that recommended by SMACNA-Duct Construction Standards for ductwork of same size and pressure class; but not less than gauge dimension recommended by manufacturer based upon application and acoustic DIL requirements (or 16-gage for outer casing and 22-gage for inner casing).
- C. Acoustic Fill: Provide inorganic mineral or mold blocking cloth lining material, inert, vermin and moisture proof, of sufficient density to obtain specified acoustic performance. Pack under not less than 5 percent compression to eliminate voids due to vibration and settling.
- D. Acoustic Performance: Provide silencer ratings that have been determined in such to reverberative room test facility. Test silencer with air flow in both directions through silencer, in accordance with ASTM E477, "Methods of Testing Duct Liner Materials and Prefabricated Silencers for Acoustical and Airflow Performance."
 - 1. For acoustic ratings, include Dynamic Insertion Loss and Self Noise Power Levels for both forward flow (air and noise in same direction) and reverse flow (air and noise in opposite directions) with airflow of at least 2,000 FPM face velocity.
- E. Aerodynamic Performance: Provide silencers with static pressure loss equal to or less than that scheduled.
- F. Certification: Provide certified test data on Dynamic Insertion Loss, Self-Noise Power Levels, and Aerodynamic Performance. Conduct all rating tests at same facility. Open testing facility for inspection by Architect/Engineer if requested.
- G. Manufacturers: Subject to compliance with requirements, provide duct silencers of one of the following:
 - 1. Vibro-Acoustics
 - 2. Aeroacoustic Corporation
 - 3. Industrial Acoustics Co.
 - 4. Price
 - 5. Or Equal.

2.24 AIR OUTLETS AND INLETS (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. Ceiling Air Diffusers:
 - 1. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation. Stamped face diffusers will not be acceptable.

2. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw, drop and noise criteria ratings for each size device as listed in manufacturer's current data.
 3. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
 4. Types: Provide ceiling diffusers of type, capacity, throw, blow and with accessories as listed on diffuser schedule.
 - a. Ceiling Diffusers shall be of the restricted multi-orificed jet induction and air mixing type consisting of louver sections with built-in diffusing vanes. The vanes shall be arranged to discharge air from adjacent louvers at an angle of 45 degrees in opposite directions to insure rapid mixing of primary and room air. Diffusing vanes shall be welded and mechanically fastened to the adjacent louver sections to make a rigid unit. The vanes shall extend to the discharge edges of the louvers. Where louver sections join the core frame, the louver ends shall be welded to the core frame. The leaving edge of each louver shall be hemmed and the louver ends shall be rounded and hemmed before welding to the core frames.
 - b. Diffusers shall be fabricated of aluminum or steel-welded construction, and shall be provided with a removable core permitting easy access to the neck connection. The diffuser neck shall extend no less than 1 in. above the core to accommodate an internal duct connection to prevent leakage into the ceiling space.
 - c. Finish shall be baked enamel. Color as selected by architect, provide sample selection chart.
 - d. Plaque diffuser shall be one piece seamless back cone with round inlet color and inner removable plaque assembly.
 5. Diffuser Dampers:
 - a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser. Provide in each ceiling diffuser.
 6. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
 - a. Tuttle & Bailey Agitair Series
 - b. Metalaire – "5000 IV"
 - c. Price
 - d. Krueger
 - e. Or Equal
- B. Wall Registers and Grilles:
1. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.
 3. Compatibility: Provide registers and grilles with border styles that are compatible with adjacent systems, and that are specifically manufactured to fit into wall and ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of construction which will contain each type of register and grille.
 4. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule:
 5. Pattern: Register and grille patterns shall have style as identified on Drawings:
 6. Dampers: Opposed Blade adjustable assembly, key operated from face of register.
 7. Accessories:
 - a. Plaster Frame: Perimeter frame designed to act as plaster stop and register or grille anchor. Provide where required.
 - b. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
 8. Finish: Register and Grille Finishes shall be baked enamel. Color as selected by architect, provide sample selection chart.
 9. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one the following:
 - a. Price
 - b. Tutte & Baliley Agitair (Air Devices)
 - c. Metalaire
 - d. Price
 - e. Krueger
 - f. Or Equal.
- C. Ceiling Registers and Grilles:
1. General: Except as otherwise indicated, provide manufacturer's standard "Egg-Crate" type registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
 2. Compatibility: Provide registers and ceiling grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling construction.
 3. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule.
 4. Register and Grille Materials:
 - a. Aluminum Construction: Manufacturer's standard extruded aluminum frame and core.

5. Register and Grille Faces:
 - a. 1/2 in. x 1/2 in. "Egg-Crate" with one in. border frame.
 6. Register and Grille Dampers:
 - a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register (provide for registers only).
 7. Register and Grille Finishes shall be baked enamel. Color as selected by architect, provide sample selection chart.
 8. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:
 9. Agitair (Air Devices)
 - a. Price
 - b. Metalaire
 - c. Krueger
 - d. Or Equal.
- D. In Wall Displacement Diffuser
1. Description: Furnish and install in wall displacement diffusers with the sizes and capacities indicated on the plans and air outlet schedule.
 2. Performance: Air shall be delivered to the space at low noise levels and low velocities that are even across the diffuser face, in all ducting configurations and without the use of nozzles.
 3. Diffuser Manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-2006. Performance data for Draft Rate (%DR) shall be provided based on tests in accordance with ASHRAE Standard 55-2004. A manufacturer software program that allows room comfort evaluation for specific operating conditions and diffuser locations shall be available to aid in performance assessment. If such a computer program is not available from the manufacturer, the manufacturer shall supply, free of charge, a CFD model of the representative spaces completed by a modeling contractor who has demonstrable qualifications to model such spaces. These shall include no less than 10 years of experience in the modeling of displacement ventilation systems, thorough validation of the code through comparison to empirical data as well as a list of references.
 4. Construction: The 1 way flat faced in-wall displacement diffuser, shall be constructed with an equalization baffle behind the operative diffuser face for uniform, low velocity, distribution of supply air. Both the equalization baffle and face shall be securely retained in the diffuser frames. Plastic nozzle arrays or any plastic components are unacceptable. The diffuser frames shall be constructed of 20 gauge steel for rigidity and protection of the operative face. The operative face shall be constructed of painted 18 gauge perforated steel, and the frame shall be provided in painted 20 gauge steel. The plenum shall be 24 gauge steel. The internal baffling elements shall be constructed of aluminum. The diffuser shall be available for duct connection at the top. The paint shall be powder coat polyester, color as selected by architect, provide sample selection chart. Epoxies and their derivatives are unacceptable. Visible non-metallic components are unacceptable.

5. Mounting/Fastening: The diffuser front panel shall be bolted to the plenum through the wall with factory provided fasteners.
 6. Manufacturer: Subject to compliance with requirements, provide flat faced displacement diffusers of one of the following:
 - a. Price
 - b. Metalaire
 - c. Titus
 - d. Or Equal.
- E. Flat Face Displacement Diffusers
1. Description: Furnish and install flat face displacement diffuser with the configurations and mounting types indicated on the plans and air outlet schedule.
 2. Performance: Air shall be delivered to the space at low noise levels and low velocities that are even across the diffuser face, in all ducting configurations and without the use of nozzles. Diffuser Manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-2006. Performance data for Draft Rate (%DR) shall be provided based on tests in accordance with ASHRAE Standard 55-2004. A software program that allows room comfort evaluation for specific operating conditions and diffuser locations shall be available to aid in performance assessment. If such a computer program is not available from the manufacturer, the manufacturer shall supply, free of charge, a CFD model of the representative spaces completed by a modeling contractor who has demonstrable qualifications to model such spaces. These shall include no less than 10 years of experience in the modeling of displacement ventilation systems, thorough validation of the code through comparison to empirical data as well as a list of references.
 3. Construction: The 1 way flat faced recessed displacement diffuser shall be constructed with an equalization baffle behind the operative diffuser face for uniform, low velocity, distribution of supply air. Both the equalization baffle and face shall be securely retained in the diffuser frames. Plastic nozzle arrays or any plastic components are unacceptable. There shall be no visible fasteners on the front panel. The operative face shall be constructed of painted 18 gauge perforated steel. The installation frame shall be constructed of 24 gage steel. The internal baffling elements shall be constructed of aluminum. The paint shall be powder coat polyester, color as selected by architect, provide sample selection chart.. Epoxies and their derivatives are unacceptable. Visible non-metallic components are unacceptable. The diffuser shall be supplied with an installation frame for recessed installation that is not visible from the room. (The diffuser shall be supplied with an installation frame for recessed installation which allows the diffuser to be installed in areas where plaster is required).
 4. Mounting/Fastening: The diffuser shall be installed within the manufacture provided plenum, refer to details sheet M2.4 for further information. Plenum to be provided with mounting clips, all by diffuser manufacture. The diffuser shall have no visible fasteners or framing, and shall be held within the supplied plenum via secure mounting clips.

5. Manufacturer: Subject to compliance with requirements, provide flat faced displacement diffusers of one of the following:
 - a. Price
 - b. Metalaire
 - c. Trox
 - d. Krueger
 - e. Or Equal.
- F. Ceiling Mounted Displacement Diffusers
1. Description: Furnish and install ceiling mounted displacement diffuser with the sizes and capacities indicated on the plans and air outlet schedule.
 2. Performance: Air shall be delivered to the space at low noise levels and low velocities that are even across the diffuser face in all ducting configurations and without the use of nozzles. Diffuser Manufacturer shall provide sound and pressure drop data derived from tests in accordance with ASHRAE Standard 70-2006. Performance data for Draft Rate (%DR) shall be provided based on tests in accordance with ASHRAE Standard 55-2004. A manufacturer software program that allows room comfort evaluation for specific operating conditions and diffuser locations shall be available to aid in performance assessment. If such a computer program is not available from the manufacturer, the manufacturer shall supply, free of charge, a CFD model of the representative spaces completed by a modeling contractor who has demonstrable qualifications to model such spaces. These shall include no less than 10 years of experience in the modeling of displacement ventilation systems, thorough validation of the code through comparison to empirical data as well as a list of references.
 3. Construction: The 1 way flat faced ceiling mounted Displacement diffuser shall be constructed with an equalization baffle behind the operative diffuser face for uniform, low velocity, distribution of supply air. Both the equalization baffle and face shall be securely retained in the diffuser frames. Plastic nozzle arrays or any plastic components are unacceptable. The diffuser frames shall be constructed of high strength aluminum extrusion for rigidity and protection of the operative face and side panels. There shall be no visible fasteners on the front or side panels. The operative face shall be constructed of painted 18 gauge perforated steel, and the frame shall be provided in painted 20 gauge steel. The internal baffling elements shall be constructed of Aluminum. The diffuser shall be available for duct connection at the top, bottom, side or rear of the diffuser with a factory inlet. The paint shall be powder coat polyester, color as selected by architect, provide sample selection chart. Epoxies and their derivatives are unacceptable. Visible non-metallic components are unacceptable.
 4. Mounting/Fastening: The diffuser shall integrate into standard T-Bar ceilings and shall have no visible fasteners.
 5. Manufacturer: Subject to compliance with requirements, provide flat faced displacement diffusers of one of the following:
 - a. Price
 - b. Metalaire

- c. Trox
- d. Krueger
- e. Or Equal.

G. Linear Diffusers

1. Linear slot diffusers shall be furnished and installed as indicated on the drawings.
2. Provide shop drawings accompanied by itemized list indicating units' location and appropriate product submittal drawings provided by the manufacturer.
3. Exact dimensions of walls and ceiling are as per the architectural drawings. Install diffusers so they fit properly in the ceiling system with suspension wire (48 in. o/c MAX.) and/or attachment plates — as required.
4. Coordinate installation with General Contractor and other sub-contractors.
5. The linear slot diffuser shall utilize heavy wall extruded aluminum air deflector frames. These frames shall be designed to accommodate notched compressible space bars, complete with integral hanger, spaced approximately 24 in. on center. The steel air pattern controllers are fully adjustable and can be moved from side to side to create various air pattern configurations. These dual pattern controllers shall be fully adjustable to allow shut-off without adding any blank-off devices. The spacer bars and pattern controllers shall be removable for on-site modification and trimming.
6. The Linear slot diffuser shall be complete with factory end conditions as shown or indicated.
7. Supply air engineered plenums shall be provided and manufactured of heavy gauge wipe coat steel. These units shall be insulated with a side inlet collar.
8. When engineered plenum end caps cannot be positioned directly over the linear spacer bar due to field conditions, install MB Blank-Off from plenum end cap to next spacer bar.
9. MB Blank-Off shall be manufactured of heavy gauge steel painted black.
10. Linear Bar Grilles: Furnish and install extruded bar supply/return grilles of the sizes and mounting types indicated on the plans and outlet schedule.
 - a. Construction: Grilles shall have fixed degree blades, spaced 7/16 in. on center. The outlet core shall have extruded aluminum receiving bar. Blades shall run parallel to the long dimension of the grille. The grille border shall be heavy duty extruded aluminum construction with factory mitered corners and reinforcing support bars for extra support for the core receiving bar. The support and receiving bars shall not exceed 8 in. on center. The core shall be held into the border with removable core clips allowing the removal of the core without special tools.
 - b. Finish: The grille shall be finished, color as selected by architect, provide sample selection chart. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.

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- c. Manufacturer: Subject to compliance with requirements, provide linear bar grilles of one of the following:
 - 1) Price
 - 2) Tuttle & Bailey - Agitair
 - 3) Metalaire
 - 4) Krueger
 - 5) Or equal

2.25 VARIABLE AIR VOLUME BOX (VAV)

- A. General: Provide factory-fabricated and tested air terminals as shown on drawings, selected with performance characteristics which match or exceed those indicated on schedule.
- B. Casings: Construct of die-cast aluminum or sheet metal of the following minimum thicknesses:

	Steel	Aluminum
1. Upstream Pressure Side:	22-ga.	0.032 in.
2. Downstream Pressure Side;	22-ga.	0.025 in.
3. Provide hanger brackets for attachment of supports.		
4. Linings: Line inside surfaces of casings with hospital grade lining material meeting ASTM Standard C1071 to provide acoustic performance, thermal insulation, and to prevent condensation on outside surfaces of casing. Provide minimum thickness of 1 in. Secure lining to prevent delamination, sagging or settling. Seal edges of lining to prevent fraying. <ul style="list-style-type: none">a. Cover liner surfaces and edges with mylar, foil or perforated metal.		
5. Leakage: Construct casings such that when subjected to 0.5-in w.g. pressure for low pressure units, and 3.0-in w.g. pressure for high pressure units, total leakage does not exceed 4 percent of specified air flow capacity with outlets sealed and inlets wide open. Construct air dampers such that when subjected to 6.0-in w.g. inlet pressure with damper closed, total leakage does not exceed 10 percent of specified air flow capacity.		
- C. Air Dampers: Construct of materials that cannot corrode, do not require lubrication, nor require periodic servicing. Provide maximum volume dampers, pressure independent that are calibrated in cfm, factory-adjusted, and marked for specified air capacities. Provide mechanism to vary air volume thru damper from minimum to maximum, in response to signal from thermostat.
- D. Controls: Provide controls accurate to 1.5 deg. F(0.8 deg. C) and adjustable from 65 deg. F (22 deg. C) to 85 deg. F (29 deg. C).
 - 1. ATC Contractor to provide and field install DDC controls, compatible with automatic temperature control system specified in other Division-23 sections. All testing and commissioning shall be completed in field.
- E. Identification: Provide label on each unit indicating Unit Number, cfm range, cfm factory-setting, and calibration curve (if required).

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- F. Silencer:
1. Silencer section shall consist of a three foot minimum 22ga solid metal casing, 22ga perforated liners, and absorptive acoustic fiberglass liner.
 2. Acceptable methods of silencer construction shall be button lock, Pittsburgh lock, and welds. In situations where these methods are not feasible, rivets can be used. Screws or other mechanical fasteners on the silencer will not be acceptable.
 3. The silencer noses and perforated liners shall be rigidly fastened to the casing of the silencer on both the top and bottom.
 4. The silencer section acoustic media shall be shot free inorganic glass fiber with long, resilient fibers, bonded with thermosetting resin, and contain 50 percent recycled media. Glass fiber shall be packed with a minimum 10 percent compression to eliminate voids and settling; density shall consistent with that used to generate catalog test data. Combustion ratings for acoustical media shall be equal to or less than the combustion ratings noted below when tested in accordance with ASTM E84, UL713, and NFPA 255:
 - a. Flame Spread Classification: 25
 - b. Smoke Development Rating: 50
 5. Silencer shall be Price model SDVQ or equal.
- G. Manufacturer: Subject to compliance with requirements, provide variable air volume boxes of one of the following:
1. Price
 2. Metalaire
 3. Nailor
 4. Or equal

2.26 CONSTANT VOLUME DAMPERS

- A. Provide Adjustable Constant Airflow Regulators by American ALDES Ventilation Corporation, or equal. The constant volume dampers shall operate solely on duct pressure and require no external power supply. Each regulator shall be capable of being field adjusted to the required airflow setpoint, as indicated on the schedule, by manual adjustment of the control device using an Allen/Hex key. The device shall be rated for use in air temperatures ranging from -22° to 212°F (-30° to 100°C).
- B. Constant volume dampers shall be capable of maintaining constant airflow within $\pm 10\%$ for nominal airflow > 60 CFM (100 m³/h) and ± 5 CFM (10 m³/h) for nominal airflow < 60 CFM (100 m³/h) throughout the target operating pressure range of 0.2 to 4.0 in. w.g. (50 to 1000 Pa). differential pressure. Sound power levels shall not exceed those for each size and CFM rating as scheduled.
- C. The device is constructed of a laser-welded, galvanized steel body, a translucent plastic control device, and a double-lip airtightness seal around the circumference to ensure a tight, no-leak fit. The integral control device shall be comprised of an aluminum damper and a stainless steel spring and shaft fitted to PTFE (polytetrafluoroethylene) bearings. A pneumatic piston damper prevents overshoot and oscillation of the control damper and ensures an accurate response and control behavior.

- D. All Adjustable Constant Airflow Regulators will require no maintenance and must be warranted for a period of no less than five (5) years. The Adjustable Constant Airflow Regulators shall be installed in tight ducting systems in accordance with all applicable codes and manufacturer's instructions.

2.27 DUCTLESS COOLING UNITS (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

A. Evaporator:

1. General: The unit shall be factory assembled, wired and tested. Contained within the unit shall be all factory wiring and internal piping, control circuit board, and fan motor. The unit in conjunction with the wired, wall mounted controller shall have a self-diagnostic function, three-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be purged with dry nitrogen before shipment from factory.
2. Cabinet: The casing shall be ABS plastic factory finish. Cabinet shall be designed for suspension mounting and horizontal operation. The rear cabinet panel shall have provisions for a field installed filtered outside air intake connection.
3. Fan: The evaporator fan shall have three high performance, double inlet, forward curve sirocco fans driven by a single motor. The fans shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings. The indoor fan shall consist of four speeds: Low, M1, M2 and Hi.
4. Vane: There shall be a motorized horizontal vane to automatically direct air flow in a horizontal and downward direction for uniform air distribution. The horizontal vane shall provide a choice of five vertical airflow patterns selected by remote control. There shall also be a set of vertical vanes to provide horizontal swing airflow movement selected by remote control.
5. Filter: Return air shall be filtered by means of an easily removable washable filter.
6. Coil: The evaporator coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing. The multi-angled heat exchanger shall have a modified fin shape that reduces air resistance for a smoother, quieter airflow. All tube joints shall be brazed with PhosCopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil.
7. Control: The control system shall consist of two microprocessors, one on each indoor and outdoor unit, interconnected by a single non-polar two-wire cable. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. For A-Control, a three conductor 14 ga. AWG wire with ground shall provide power feed and bi-directional control transmission between the outdoor and indoor units. Where separate power is supplied to the indoor and outdoor units, a two 20 ga. AWG wire shall be run between the units to provide forbid-directional control communication. The system shall be capable of automatic restart when power is restored after power interruption. The system shall have self-diagnostics ability, including total hours of compressor run time. Diagnostics codes for indoor and outdoor units shall be displayed on the wired controller panel.

B. Condensing:

1. General: The outdoor unit shall be equipped with a control board that interfaces with the indoor unit to perform all necessary operation functions. The outdoor unit shall be capable of operating at 0 degrees F, (-18 degrees C) ambient temperature without additional low ambient controls. The outdoor unit shall be able to operate with a maximum height difference of 100 ft. and have maximum refrigerant tubing length of 165 ft. between indoor and outdoor units without the need for line size changes, traps or additional oil. The outdoor unit shall be completely factory assembled, piped, and wired. Each unit must be test run at the factory.
2. Cabinet: The casing shall be constructed from galvanized steel plate, coated with a finished with an electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection and have a factory finish. The fan grille shall be of ABS plastic.
3. Fan: The fan motor shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across if from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent contact with moving parts.
4. Coil: The L shaped condenser coil shall be of copper tubing with flat aluminum fins to reduce debris build up. The coil shall be protected with an integral metal guard. Refrigerant flow from the condenser shall be controlled by means of linear expansion valve (LEV) metering orifice. The LEV shall be control by a microprocessor controlled step motor.
5. Compressor: The compressor shall be a scroll compressor with variable speed inverter technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which results in vast energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be intermittently applied to the compressor motor to maintain enough heat. The outdoor unit shall have an accumulator and high pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.
6. Electrical: The electrical power of the unit shall be as indicated on the drawings. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control signal between the indoor unit and the outdoor unit shall be pulse signal 24 volts DC. The unit shall have Pulse Amplitude Modulation circuit to utilize 98 percent of input power supply.
7. Provide BMS interface for system status monitoring. Refer to HVAC control drawings for requirements.
8. Manufacturer: Subject to compliance with requirements provide DCU AC Units of one of the following:
 - a. Mitsubishi
 - b. LG
 - c. Daikin
 - d. Or Equal

2.28 CONDENSATE DISCHARGE PUMPS (Refer to various equipment schedules for locations and SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

- A. General: Provide where indicated, condensate pumps of capacity as scheduled, to be field installed in various air handling equipment drain pans, consisting of ABS housing, pump, check valve, safety switch, and thermal overload protection. Factory assembled unit must be UL/CSA listed.
- B. High-Capacity Pumps
 1. Reservoir: Construct of ABS plastic with a 3/10 capacity volume.
 2. Pump: 25 GPH at 15TDH vertical type pump with stainless steel motor shaft, rustproof, ABS volute, with safety switch.
 3. Housing and Cover: Each shall be ABS plastic.
 4. Manufacturers: Subject to compliance with requirements, provide high-capacity condensate pump of Little Giant or approved equal:
- C. Low-Capacity Pumps
 1. Pump: 8 GPH at 33TDH reciprocating piston pump direct discharge with no storage reservoir.
 2. Detection Unit: Low-maintenance filter free with a three level float (on/off/alarm).
 3. Pump Housing and Detection Unit: Each shall be ABS plastic.
 4. Manufacturers: Subject to compliance with requirements, provide low-capacity condensate pump of Sauermann or approved equal.

2.29 FIRESTOP SYSTEMS

- A. General: Provide firestopping at all fire-rated construction where penetrated by the Work of this Section. Also, provide smoke sealing at all smoke barrier and smoke partition construction where penetrated by the work of this section.
- B. Refer to Section 078100 – APPLIED FIRESTOPPING and Section 078400 - FIRESTOPPING, for all product requirements for maintaining integrity of fire-rated and smoke rated construction at penetrations.

2.30 WALL AND CEILING ACCESS DOORS

- A. General: Furnish and install access panels, at all new construction where required for access to the Work of this Section. Furnish access doors for access to all concealed control valves, motor operated dampers, fire doors, and all other concealed parts of the HVAC system that require accessibility for the proper operation and maintenance of the system.
- B. Refer to Section 083100 - Access Doors and Frames, for all product requirements for furnishing access panels.
- C. Coordinate locations and schedule with the work of trades involved with construction in which access panels will be installed.

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- D. Access doors shall be heavy gage steel with 1 in. frame. Door shall be fastened to frame with continuous piano hinge. Entire door and frame assembly shall be prime painted and be completed with cylinder lock and two keys. Door and frame shall match fire rating of wall or ceiling installed into.
 - E. Manufacturer: Subject to compliance with requirements, provide access doors of one of the following:
 - 1. Inland Steel Products Company, "Milcor"
 - 2. Walsh-Hannon-Gladwin Inc., "Way Loctor"
 - 3. Or Equal.

2.31 WATER TREATMENT SYSTEMS

- A. RELATED DOCUMENTS: All M-Series, E-Series and P-Series Drawings and related specifications.
- B. SUMMARY
 - 1. The Water Treatment is to include both construction services of hydrotesting, precleaning, flushing and passivation. Also, one year of service after the construction is completed. For all systems in the facility.
 - 2. The Water treatment maintenance services shall be comprehensive in nature. The intent of the water treatment services shall be to:
 - a. Maintain clean water systems, free of harmful growths or bacteria, especially pathogens and other bacteria that can inhibit proper heat transfer, cause disease or enhance corrosion.
 - b. Prevent excessive corrosion of piping and all equipment.
 - c. Maintain pH, dissolved solids, and particulate at optimum levels.
 - d. Prevent deposit or scale buildup on heat transfer surfaces.
 - 3. The Water Treatment Service Company shall provide all testing, chemicals, control equipment, chemical feed pumps, monitoring equipment (where required), service/labor, and expertise to meet these objectives.
 - 4. The systems to receive water treatment service are as detailed below, each system with the exception of the condenser loop is provided with 35% by weight propylene glycol.
 - a. Chilled Water
 - 1) Chilled Loop – with one (1) 320 ton modular air cooled chiller as scheduled.
 - b. Heating Hot Water
 - 1) Heating Hot Water Loop – two (2) high efficiency gas fired boilers.
 - 5. This section includes the following water treatment and equipment for this project:
 - a. Manual and automatic chemical feed equipment.
 - b. Hydrotesting chemicals
 - c. Cleaning chemicals
 - d. Passivation chemicals

- e. Chemical treatment test equipment.
 - f. Chilled Water Corrosion and Biocide Treatments
 - g. Heating Hot Water Corrosion and Biocide Treatments
 - h. Services to be provided.
6. The Water treatment program will cover an additional one year period after the substantial completion of the construction period.

C. QUALIFICATIONS OF WATER TREATMENT SERVICE PROVIDER

1. The Water Treatment Service Provider must provide water treatment programs to actively serve a clientele in the Framingham, MA area. They shall be familiar with, experienced in, and regularly engage in the design, manufacture, application, and service of cooling water – open recirculating water systems, closed water systems (both hot and chilled water) and dual temperature and Cogen hot water systems. They shall demonstrate experience in areas that include training, testing, and troubleshooting such systems.
2. The Water Treatment Service Provider shall provide documentation and references of having a minimum of five (5) years' experience with water treatment programs similar to that offered under this specification and using similar chemical treatment products. Include in shop drawing submission.
3. The Water Treatment Service Provider must have at least five (5) active treatment programs using chemicals and services similar to those offered under this proposal and functioning with a makeup water chemistry similar to that available to the Framingham, MA Documentation and references, including names and telephone numbers must be included in shop drawing submission.
4. The Water Treatment Service Provider must have a technical sales/service facility within 200 miles of Framingham, MA and be capable of responding personally to the site within 24 hours of notification. This facility shall include individuals who can not only fulfill various ordering and delivery requirements but who can also troubleshoot water and equipment problems and provide technical solutions. The individual assigned to service the program herein proposed must have documentable experience of at least five (5) years in similar water treatment service work plus evidence of at least five (5) years tenure in the same geographical area and with the same client accounts. **An individual with a Certified Water Technologist certification or equivalent experience is required.** This individual must also be supported by a staff of senior engineering experts and a well-equipped corporate laboratory capable of performing special analyses on corrosion coupons, deposits, microbiological samples, and other critical water treatment parameters. Documentation to be issued during the submittal process for review and approval.

D. DEFINITIONS

1. Certified Water Technologist (CWT) – The CWT is a certification that shows the holder to have the expertise, experience, and knowledge to provide the highest standards of service for providing and monitoring a water treatment program. They pride themselves on making facilities as efficient as possible using the latest water treatment technology and techniques to save energy and prevent scale, corrosion, fouling, deposition and microbiological growth.

2. Individuals with the CWT designation have personally committed themselves to excellence in the water treatment industry. Each CWT has passed a rigorous exam that covers all aspects of water treatment technology, and they must recertify every five years to maintain the credential. The CWT designation is administered by the Association of Water Technologies.

E. PERFORMANCE REQUIREMENTS

1. Water quality for HVAC systems shall minimize corrosion, scale build-up, general particulate fouling and biological growth to allow for optimum efficiency of the HVAC equipment without creating a hazard to operating personnel or the environment. The systems will be chemically treated to prevent such occurrences. No chromates or other regulatory (State, Local or Municipal) forbidden chemicals shall be utilized.
2. Hydrotesting, cleaning, flushing, passivation of all of the systems in this project are to be done by the Mechanical Contractor with oversight from the Water Treatment Service Provider. The Water Treatment Service Provider is responsible for determining the compatibility of the chemicals that will be utilized with all of the metallurgies involved.
3. The HVAC water treatment should be based on the quality of water available at the project site, HVAC system equipment material characteristics, metallurgies involved and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction. A report documenting that the Water Treatment Service Provider analyzed the incoming project site water, and describing its characteristics, shall be supplied to the Construction Manager, Project Engineer and the Facility Maintenance Department. The testing must include: date sample was taken, date sample was analyzed for P&M alkalinity, calcium, magnesium, total hardness, pH, conductivity, chlorides, sodium, sulfate, zinc, potassium, silica, iron, copper, barium, aluminum, manganese, strontium, ortho-phosphate, poly-Phosphate and nitrates.
4. The systems shall not be hydrotested without a chemical additive being added to the make-up water. The chemical additive shall include a Vapor Phase corrosion additive to prevent flash rusting when the system is drained. The hydrotesting must be overseen by the water treatment service provider in order to prevent excessive corrosion.
5. The pre-cleaning and flushing of the systems must be done with the oversight of the Water Treatment Service Provider. It must also be documented in a formal report supplied to the construction manager and project engineer, including the steps taken during pre-cleaning and flushing. Water analyses must be done as listed in Section E.7 on every system that is to be pre-cleaned and flushed during every phase done during each of the steps and a final flushing water quality analysis with particle size distribution analyses conducted on the final flush water.

6. The passivation of the systems must be done with the oversight of the Water Treatment Service Provider. It must also be documented in a formal report supplied to the general contractor and project engineer, including the steps taken during the passivation, especially if a galvanized or aluminum metallurgy is utilized. Passivation of these metallurgies is extremely important and under no circumstances should damage to these metallurgies be allowed. If there is an issue with timing and passivation, the water treatment service provider will provide documentation to the Construction Manager, Project Engineer and the Manager of Facilities. discussing the facts and the issues before he continues. Water analyses, as listed in Section E.7, must be done on every system and must be done during every phase done during each of the steps of passivation. For the cooling tower, pictures need to be taken during each of the steps to verify conformance.
7. A formal report should also document the quality of the treated systems. The quality of the treated water must meet the specifications, if there are any, set forth by the HVAC equipment manufacturers. If no such specifications exist for the equipment, a full analysis must be done (See Section E.7). This analysis must also include inhibitor levels and particle size distribution analysis, that documents the quality of the water/fluid. If glycol is required in the project, the full analysis must include organic acidity, glycol degradation products, corrosion inhibitors, scale promoters, contaminants, corrosion by-products and general qualities of the glycol including concentration, type and freeze point.
8. Water Testing that must be done on all samples for the precleaning, flushing and passivation stages:

P & M Alaklinity (as CaCO ₃)	Zinc (as Zn)
Chlorides (as NaCl)	Silica (as Si)
Calcium (as Ca)	Aluminum (as Al)
Magnesium (as Mg)	Total Iron (as Fe)
Total Hardness (as CaCO ₃)	Dissolved Iron (as Fe)
pH	Total Copper (as Cu)
Conductivity	Dissolved Copper (as Cu)
Sodium (as Na)	Manganese (as Mn)
Potassium (as K)	Ortho – Phosphate
Sulfate (as SO ₄)	Poly - Phosphate
Oil and Grease	MBAS (Surfactants)
Total Organic Carbon	Suspended Solids

The stages that analyses are required are:

- Before Cleaner is added

- After Cleaning
 - After Flushing (must include Particle Size Distribution Analysis)
 - After Passivation (must include Particle Size Distribution and Inhibitor Levels)
9. The water chemistry and quality of the chemical treatment program during the one year period after the initial construction phase will influence the corrosion rates of the system. These shall be measured by corrosion coupons using un-passivated coupons and following the ASTM procedures for monitoring corrosion rates. The Water Treatment Service Provider shall supply standard ASTM D2688 Method B corrosion coupons in carbon steel (C1010), copper (CDA110), Galvanized Steel and other metallurgies in the systems for installation in coupon holders to be placed in the systems. The Service Provider will conduct the testing by installing the coupons in the coupon holders and supplying all coupon racks. (Note: Coupons are not to be pre-passivated). These coupons will be reweighed by the supplier company and examined by them after exposure for weight loss, deposit accumulation, deposit analysis (where appropriate) and general appearance. A written report with photographs (before and after cleaning) of the results of this examination will be submitted to the Construction Manager, Project Engineer and the Facilities Manager of the Middle School within two weeks of coupon removal. Coupons will be installed in various systems to establish a historical data base. Priority will be given to systems where there is a suspicion or evidence of a corrosion problem but in no case in less than the following systems:

- Four sets per year in all chilled and hot water systems.

These surveys shall be run at between 30 days to 90 days following initiation of the treatment program. In no case shall coupons be exposed for longer than a 90-day period. The treatment program shall be designed to maintain for the corrosion rates as listed in the table below:

System Type	Carbon Steel (C1010)	Copper (CDA110)
Chilled Closed Loop	Less than or equal to 0.2 mpy	Less than or equal to 0.1 mpy
Hot Water Closed Loop	Less than or equal to 0.2 mpy	Less than or equal to 0.1 mpy

Note: These rates assume that the metal loss is uniform with no pitting or localized attack including gouging, etching, microbial attack or crevice attack. Conditions such as those are not acceptable. If they are noted, the cause should be addressed with follow-up testing to confirm improvement. Localized attack at the coupon holder may be ignored if the treatment is unable to interact with the coupon in this area and no other abnormalities are noted.

10. The water chemistry and quality of the chemical treatment program during the two year period after the initial construction phase will influence how the system operates. The Water Treatment Service Provider will perform monthly water analyses based on the tables below. From these analyses the Water Treatment Service Provider will properly assess the performance of the complete water treatment program. A monthly formal report will be issued to the Construction Manager, the Project Engineer and the Manager of Facilities.

Table of Monthly Testing Required		
Tests	Chilled Water & Hot Water	City Water
P Alkalinity		X
M Alkalinity		X
Chloride	X	X
Calcium Hardness		X
Total Hardness	X	X
pH	X	X
Dissolved Iron	X	X
Conductivity	X	X
Silica		X
Dissolved Copper	X	
Ortho-Phosphate		X
Poly-Phosphate		
Phosphonate		
Zinc		
Inhibitor Concentration including azole	X	
Total Bacteria – Plate Count	X	
Total Fungal Count	X	
Total Slime Formers	X	
Sulfate Reducing Bacteria	X	
Iron Reducing Bacteria	X	

Denitrifying Bacteria	X	
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11. The water chemistry and quality of the chemical treatment program during the two year period after the initial construction phase will influence the heterotrophic biological growth in these systems. Microbiological population/growth analyses shall be conducted on chilled bulk waters on a monthly basis, using dip stick methods, petri-film or ATP or by the corporate support laboratory, using incubated culture methods. A minimum of one such sample per month will be run for each operating cooling tower with additional tests as required where it is suspected that problems or upset conditions exist. All results shall be submitted in writing within fifteen (15) days of the test. For field testing and immediate results, dip stick, petri-film and ATP analysis will all be acceptable but these results must be supported by a detailed analysis in the corporate support laboratory. Each test must be run on a sample drawn from the same location, under the same operating conditions, and at the same time following biocide application. Total microbiological population shall be maintained at 1,000 organisms per milliliter or less. Total fungal populations shall be maintained at non- detectable. SRB and IRB, along with other corrosion causing bacteria shall also be maintained at non-detectable levels. A formal report issued to the Construction Manager and the Project Engineer should provide evidence of this upon every service visit. If bacteria is above these levels in these systems the Water Treatment provider will provide extra biocide to control these bacteria at no extra cost.
12. Microbiological population/growth analyses shall also be conducted on screen coupons placed in corrosion coupon racks to monitor slime or sessile bacterial growth in the chilled bulk waters on a monthly basis, using dip stick methods, or by the corporate support laboratory, using incubated culture methods. A minimum of one such sample per month will be run for each operating cooling tower with additional tests as required where it is suspected that problems or upset conditions exist. All results shall be submitted in writing within fifteen (15) days of the test. Total microbiological population shall be maintained at 1,000 organisms per milliliter or less. Total fungal populations shall be maintained at non-detectable. SRB and other corrosion causing bacteria shall also be maintained at non-detectable levels. A formal report issued to the Construction Manager and the Project Engineer should provide evidence of this upon every service visit. If bacteria is above these levels in these systems the Water Treatment provider will provide extra biocide to control these bacteria at no extra cost.
13. The Water Treatment Provider will also provide and change all bag filters in the closed loop filter/feeders that are installed on the closed loops.
14. The Water Treatment Provider must agree to haul away all used chemical drums, boxes or bags to an acceptable licensed disposal site at no additional cost to the City of Framingham or Middle School.
15. Chemical Containment - all chemicals on-site need to be stored in chemical containment so any leaks in the container gets captured and not distributed onto the floor or other areas at the Fuller Middle School site. All containment must be 150% of the chemical capacity of the drums or containers stored on them.

16. The Water Treatment Provider shall maintain an inventory of treatment chemicals at the facility, sufficient to ensure that the supply will not be exhausted before replenishment but not to exceed a 90-day supply beyond those containers presently in use. A 40 day inventory of materials must be maintained on site so that chemical treatments are always maintained in each system. Just in time inventory is not acceptable.
17. For each proposed water treatment chemical, Water Treatment Provider shall propose a dosage rate with test control ranges for the trace parameter. Using these dosages and the operating data for the system, The Provider shall provide a documented calculation of the estimated consumption of each chemical, on the basis of yearly consumption or consumption per 1,000 gallons of system capacity or makeup rate, as appropriate. Provider shall indicate cycles of concentration in calculating consumption of all water treatment chemicals. **This all must be included with the Submittal and Contractor's bid.**
18. Disposal of Used Containers – Water Treatment Provider must agree to haul away all used chemical drums, boxes or bags to an acceptable licensed disposal site at no additional cost to the City of Framingham or Middle School.
19. All water treatment chemicals shall be packaged in sturdy, DOT-approved drums, carboys, or bags, palletized and delivered to the specified receiving dock. All chemicals will be distributed to the different areas by the Water Treatment Provider. The Fuller Middle School personnel will not move chemicals or remove empty drums from the site. This is all the responsibility of the **Water Treatment Provider. Note: The Fuller Middle School requires a drumless operation or mini-bulk delivery program.**

F. SUBMITTALS

1. Documentation of Experience as listed in Section C
2. Documentation of CWT Certification as listed in Section C
3. List of other accounts served in the Framingham Area
4. Chemical test equipment Product Data Bulletins
5. All chemicals that will be utilized (Hydrotesting, Pre-cleaning, Passivation) – SDS's and Product Data Bulletins which must include feed rates for this project.
6. Chemical bypass feeders - Product Data Bulletins
7. All Chemical Feed Equipment - Product Data Bulletins
8. Glycol feed units - Product Data Bulletins
9. All chemicals that will be utilized for operational treatment – SDS's and Product Data Bulletins which must include feed rates for this project.
10. Calculations for use amount including all projected water use rates and chemical usage.
11. Wiring Diagrams for all control equipment - Detail power and control wiring and differentiate between manufacturer - installed and field installed wiring.
12. Flow Diagrams for all control equipment and valve package installation of equipment especially those that differentiate between manufacturer - installed and field installed.

13. Water Treatment Protocols: Written sequence of protocols to be established for hydrotesting, pre-cleaning and flushing of the piping and equipment.
14. Water Treatment Protocols: Written sequence of protocols to be established for normal operational parameters, also for shutdown and start-up.
15. Water Analysis and Formal Reports: See Section E – Examples of these documents must be supplied with the bid.
16. Operation and Maintenance Data: For sensors, injection pumps, filters, system controls, and accessories to include in emergency, operation, and maintenance manuals specified for this project.

G. QUALITY ASSURANCE

1. HVAC Water Treatment Service Provider Qualifications: An experienced HVAC Water Treatment Service Provider with a “CWT” designation as offered by the Association of Water Technologies shall be required for this project. The Water Treatment Service Provider must be capable of analyzing water qualities, installing water treatment equipment, and applying water treatment as specified in this Section.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

H. MAINTENANCE SERVICE

1. Scope of Maintenance Service: Provide services as described above and then for two years after the construction project per Section E. services.
2. The Contractors service representative shall visit the complex at least once every month. The dates of the service calls will be prearranged at the convenience of the Fuller Middle School personnel. During each of these visits, the representative will take and analyze samples as indicated within this specification, will visit with operators and supervisors in the complex as indicated to answer any questions and probe for incipient problems, and will examine performance check information for the monitors indicated within this specification. Results of field analyses plus a narrative report of observations, conclusions and recommendations will be submitted by a written report or computer generated report no later than on the next day from the date of service, with any follow-up reports discussing major issues observed at the time of the service visit being issued within one week of the service visit.
3. The technical service representative shall be available by phone within an 8-hour period and should be able to be on-site or have some technical representative on-site within 24 hours of a phone call.
4. The technical service representative shall also coordinate with the Fuller Middle School personnel the dates of chiller equipment, boiler heating equipment, and related accessories for inspection and/or troubleshooting services. Results of any such inspections shall be documented by written reports, deposit analyses and photographs, if appropriate.

5. At least two times a year, the Contractors' technical service representative shall meet with Fuller Middle School Facility Director and the Engineer of Record to review the progress of the program during the previous six months and to discuss plans for any changes or improvements in the next six months. At least one of these meetings each year should include the participation of a senior technical expert from the Contractor's corporate engineering staff.
6. The contractor may also be called on to work with the City of Framingham Consulting Engineer who could request to review all of the contractor's information.
7. At least once every six months during a service visit, the Water Treatment Service Providers' representative shall take a sample of city water makeup, from each of the chilled water, hot water heating system. Two identical samples will be taken in bottles provided by the Contractor. The second sample will be tested on the spot by the service representative but, more importantly, the first sample shall be transmitted to the Contractors' corporate laboratory for analysis. This analysis will include all the parameters the field representative has tested for and also those not able to be determined with field test kits or analyses, requiring more sensitive and precise methods, available only in the central laboratory (ex: total iron, total copper, azole concentration, polymer concentration and poly-phosphate, aluminum and barium on the city water.) The Contractors' laboratory shall report results of their analysis within one month of sample submission with interpretive comments including Langelier Index, comparison with Service Representative results and cycles of concentration based on chloride or silica. These results will be reported in writing to the Fuller Middle School personnel.
8. Occasionally the Contractors' service representative should provide special supplemental services to evaluate the condition of equipment involved with the water treatment program. Such services should include, but not be limited to, fiberoptic scoping of heat exchangers and computer analysis of chiller efficiencies. These should be provided at no additional charge to the City of Framingham or Middle School.
9. Training
 - a. The Contractors service representative shall instruct, on an ongoing basis, all Fuller Middle School operators in all the activities of a water tester, specifically in taking samples, running applicable control tests, interpreting test results, feeding chemicals, changing chemical feed rates, and modifications of treatment control equipment (pumps, timers, blowdown valves, interlocks, instrumentation, etc.). The instruction should also cover the purpose of each treatment chemical, its recommended control range, and actions to take should the test results be out of range, as well as the consequences of allowing the treatment to remain out of range.
 - b. A training program like this also must be done at least once per year and should include any new operators or employees dealing with the water treatment program.

- c. The Water Treatment Provider shall provide instruction / operation manuals in sufficient number to provide one copy for each operator, supervisor and the City of Framingham Engineer. These manuals shall include full descriptive information on chemical products being used, product bulletins and safety data sheets for each, procedures for all recommended water tests, control limits for the tests, and purpose of each chemical treatment. Water testing procedures and control limits should be posted separately near each water testing location.

10. Reports

In agreement with previous sections of this specification, the following reports shall be supplied by the Water Treatment Provider to a Chain of Command agreed upon by the Fuller Middle School or City of Framingham.

- a. A handwritten or computer report summarizing results of the service representative's monthly visits, including results of any field tests on water samples compared with recommended control ranges, usage rates of treatment chemicals, inventory control data, and a narrative interpretation of treatment control, troubleshooting observations, and suggestions for needed changes in treatment. This report shall be left at the conclusion of each service visit.
- b. Computer generated reports of the results of any performance checks such as corrosion coupons, deposit analyses, or any other analyses.
- c. Computer generated reports of the results of corroborative/supplementary water analyses conducted by the Contractors' corporate laboratory.
- d. Follow-up computer generated reports on all problems noted during the service visit, what caused them, and recommendations for correction.
- e. Computer generated summaries of the semiannual progress meetings stating the work accomplished during the past six-month period and work to be accomplished during the subsequent six-month period plus any problems needing attention by the Contractor or Fuller Middle School.
- f. Full engineering reports giving the results of any equipment inspection, documented by deposit analyses and photographs, if appropriate.

(NOTE: All reports will be sent to a list of individuals as specified by the City of Framingham to **verify that all pertinent personnel are aware of what is occurring with the water systems and to verify that communications were received.**)

I. MANUAL AND AUTOMATIC CHEMICAL FEED EQUIPMENT

1. Closed Loops (Hot and Chilled Water)

- a. Bypass Filter Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Feeder shall have a stainless steel dissolving basket that fully supports the filter bag. The filter bag shall be the 5-micron type with ring top and handle. The feeder shall have only a threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel. The filter feeder shall be similar to Neptune Model FTF-5DB.

- 1) Capacity: 5 gal. (19 L).

- 2) Working Pressure: 125 psig (860 kPa)
- b. Four Station Corrosion Coupon Test Rack and Assembly: Constructed of corrosion resistant material, complete with piping, valves, strainer, flow monitoring device, quick disconnect O-ring sealed coupon holders, and mild steel and copper coupons. Locate copper coupon downstream from mild steel coupon in the test coupon assembly. One corrosion coupon rack is necessary for each system in this specification.

J. CHEMICALS

1. Chemicals shall be furnished and installed as recommended by the Water Treatment Service Provider and the equipment manufacturer. The Water Treatment Service Provider will determine if the chemicals are compatible with piping system components and connected equipment and that they can attain water quality specified within the Specifications.
2. Hydrotest Inhibitor: All hydrotest water shall contain a corrosion inhibitor package and biocide to protect the system from corrosion and biological growth during stagnant periods or draining. This inhibitor package must be added during all hydrotesting. The corrosion inhibitor must also include a vapor phase corrosion inhibitor in case all of the system is not full. NOTE: VERIFY THAT HYDROTESTING INHIBITOR PACKAGE IS COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT SERVICE PROVIDER.
3. System Cleaner: As recommended by the Water Treatment Service Provider and system manufacturer to remove grease and petroleum products, flash rusting agents and other particulate in the system. NOTE: VERIFY THAT SYSTEM CLEANER IS COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM (Especially if Aluminum or Galvanized are Utilized.) THIS MUST BE DONE BY THE WATER TREATMENT SERVICE PROVIDER.
4. Closed Loop Water Piping Treatment Chemicals: As recommended by the Water Treatment Service Provider and system manufacturer to reduce deposits, inhibit corrosion and control biological growth. It also must comply with the system water quality performance requirements specified in Section E. This product is for use during the normal operation of the system. NOTE: VERIFY THAT SYSTEM CORROSION INHIBITORS AND BIOCIDE ARE COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT SERVICE PROVIDER.
5. Closed Loop Water Piping Passivation Chemicals: As recommended by the Water Treatment Service Provider and system manufacturer to reduce deposits, inhibit corrosion and control biological growth. It also must comply with the system water quality performance requirements specified in Section E. This product is for use during the time between flushing and glycol addition to keep the system from corroding and to keep bacteria from growing. NOTE: VERIFY THAT SYSTEM CORROSION INHIBITORS AND BIOCIDE ARE COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT PROVIDER.

K. CHEMICAL TEST EQUIPMENT

1. The supplier will provide, at minimum, a conductivity meter, glycol refractometer (if glycol is used), inhibitor verification test chemical reagents and equipment to verify that the various systems are in conformance with operational parameters. The Water Treatment Service Provider will select all of the testing required for this project for the facility operational staff to conduct in order to verify conformance.

L. TRAINING AND DEMONSTRATION

1. Train Owner's maintenance personnel to adjust, operate, and maintain HVAC water treatment systems and equipment. See Paragraph H of this Specification Section for all that must be included.

2.32 ROOFTOP MECHANICAL ENCLOSURE

A. ACCEPTABLE PRODUCTS

1. INGENIA Technologies Inc. or equal
2. The following manufacturers are approved to provide an equivalent product to the specified manufacturer, subject to compliance with specification requirements: Tiger Systems, Epsilon, Envirosep, or equal.

B. PERFORMANCE

1. Provide factory fabricated custom rooftop mechanical pump enclosures having overall dimensions as shown on the construction plans. Physical dimensions and unit arrangement are critical for equipment layout and must be as shown on the plans.
2. Refer to the chilled water pump system schedules, drawing, and details to determine the performance and requirements of all internal components and the enclosure.
3. The pump performance characteristics must be based on the actual elevation and fluid operating conditions.
4. All deviations from the specification must be clearly indicated on the submittal drawings. The contractor shall be held responsible for all additional expenses associated with the substitution of the specified product.

C. CABINET DESIGN

1. The maximum panel deflection shall be 1/240 along the panel's length seam. Cabinet shall be designed to meet SMACNA leakage class 3.

D. CABINET CONSTRUCTION

1. UNIT BASE

- a. The unit shall be constructed on a galvanized steel base. The base shall be designed to distribute loads properly to a suitable mounting surface and be braced to support internal components without sagging, pulsating or oil canning.

- b. The floor perimeter support structure of each air handling unit shall be built with galvanized steel HSS members. Framing members shall be joined with 3/8" tapered head machine bolts. Perimeter corner segments shall be joined with galvanized steel precision machined adjoining corners. All interior assembly hardware shall be consistent with the basic construction material type: Cadmium plated. The exterior assembly hardware shall be stainless steel.
- c. The base frame height shall be selected to meet the structural design load. The maximum base deflection shall not exceed 1/300, given a maximum unsupported span of 8 feet [96"].
- d. To minimize thermal gains/losses through the perimeter channel supports, the perimeter frame shall be thermally isolated from the casing. The thermal barrier shall have an R value equal or better than 0.4 per inch.
- e. To ensure sufficient height for field installed condensate P-traps, the minimum height of the perimeter channels shall be 6 inches.
- f. Each shipping module shall be equipped with a minimum of four (4) removable lifting lugs. The maximum space between the lifting lugs shall be 6 feet.
- g. To ensure sustained product life, all structural base components shall be made of galvanized steel material. Painted carbon steel components shall not be utilized unless they are baked powder coated or sand blasted and finished with a baked enamel coating. If the base components are powder coated, then the process shall be the following:
 - 1) Paint shall be applied in an electrostatic powder coating system. The electrostatic spraying shall be accomplished by applying an electrical charge to the dry powder particles while the component to be painted is electrically grounded. The charged powder and grounded workpiece create an electrostatic field that pulls the paint particles to the workpiece. The coating deposited on the workpiece retains its charge, which holds the powder to the workpiece. The coated workpiece is placed in a curing oven, where the paint particles are melted onto the surface and the charge is dissipated. The paint system shall be environmentally friendly, therefore eliminating the use of volatile organic compounds (VOC's), hazardous air pollutants (HAP's) and solvents. Individual panels must be painted prior to final assembly to ensure painting of all sheared metal edges and concealed surfaces. The paint coating shall resist 1000 hours to the standard ASTM-B117 salt spray test.
 - 2) The powder coating process shall include: Pre-washing; Rinsing; Re-washing; Rinsing cycle I; Rinsing cycle II; Oven dry @ 400 deg F; Electrostatic paint application (powder format); Baked finish @ 400 deg F.
 - 3) Color shall be as selected by Architect.

E. FLOOR SURFACE – INSULATION – UNDERLINER

- 1. The internal, visible floor surfaces shall be Diamond plate, 0.125" tick, 0.125" thick aluminum.

2. Floors shall be pitched to floor drain with recessed drainable floors that shall have catch basins with removable grates and floor drain. The minimum size of the catch basins shall be 6" wide x 6" long x 2" deep. A female NPT fitting shall be welded to the catch basin and the threaded end designed to mate with the drain pipe extension. Enclosure floor drain shall be exterior insulated and provided by enclosure manufacturer, piped by Division 22 00 00.
3. The interstitial floor space shall be sprayed with a 2.0 inches layer of HEATLOK™ foam - Zero Ozone Depletion polyurethane foam. The thermal resistance shall be R-13.0.
4. The underside liners shall be G-90 galvanized steel.
5. All floor opening shall be equipped with a 1 ½" raised floor collar to prevent water migration into the floor opening.
6. To minimize thermal gains/losses through the floor system, the perimeter frame and all internal cross members shall be totally thermally isolated from the floor and cabinet. The NO-THROUGH-METAL barrier shall have an R value equal or better than 0.4 per inch.
7. Provide electrical power conduit wiring (1"), control conduit wiring (1"), fire protection sprinkler piping (1"), City make-up water (1¼"), and 2 at 8" CHWS&R piping penetrations. Locations and sizes of penetrations shall be coordinated with the manufacturer and the HVAC Contractor prior to construction. Note: Opening size shall be adjusted as required for pipe insulation thickness.

F. UNIT CASING

1. To allow for water drainage from the roof surface, the roof panel system shall be sloped at least ¼" per foot. The roof weatherproofing system shall be independently constructed from the cabinet air seal. The interstitial space shall be vented through a soffit and louvered exhaust outlets. Multiple slopes are required for AHU's having widths larger than 128 inches.
2. All panels shall be double wall construction, load-bearing and capable of forming the enclosure without additional structural members. All panel joints shall be sealed to provide a permanent air-tight seal. Mullion spacing shall be regulated to eliminate panel pulsation and restrict the maximum deflection to 1/240 at the specified conditions.
3. Provide roof penetration for floor drain vent (3" size).
4. Individual panels shall be made with two shells inter-connected to each other with High Density Polyethylene (HDPE) in order to ensure a complete NO-THROUGH-METAL assembly.
5. All inner and outer panels shall be galvanized steel.
6. All panels shall be a minimum 2.0" thick and be insulated with polyurethane foam having an R-value equal to 13.0. The foam insulation shall not contain any Zero Ozone Depletion Substance (Zero ODS) and shall be certified by the GREENGUARD environmental institute.

7. Finish: Shop-applied, fully oven cured Polyvinylidene Fluoride (PVDF) resin based. high performance thermoplastic organic coating applied to all exposed surfaces. Provide two coat system having a nominal total film thickness of 1.25 mils and conforming to AAMA 2605. NAAMM - Metal Finishes Manual, and the following:
 - a. Resin base of 70 percent PVDF by weight, Arkema, Inc., product "Kynar 500" or Solvay Solexis. Inc. product "Hylar 5000".
 - b. Basis of Design: P.P.G. Industries Inc.: product "DuranarMica Sunstorm" in 'metallic' color to match Architect's control sample.
 - 1) Finish Coating shall be manufactured as one of the following products:
 - 2) P.P.G. Industries Inc.; product "DuranarMica Sunstorm."
 - 3) Akzo Nobel: product: "Trinar Tri-Escent II."
 - 4) Sherwin Williams (formerly Valspar), product: "Fluropon Classic 11."
 - c. Surface Preparation: Properly clean aluminum with inhibited chemical cleaner and pretreat with a chromate or chromium phosphate coating, having weight range greater than 40 mg/square foot as measured by x-ray fluorescence (XRF) per ASTM 05723 .
 - d. Primer: Corrosion resistant, liquid chromate based primer compatible with finish coating, averaging 0.2 to 0.3 mils dry film thickness.
 - e. Finish Coat (Color Coat): Polyvinylidene fluoride enamel averaging 1.00 mil dry film thickness.
8. Adjacent panels shall be assembled to each other with bolted galvanized steel compression plates. The cabinet shall be air and water tight by individually sealing each panel joint with compressed rubber butyl membranes. The compression plates shall be mounted on the exterior of the units, the assembly bolts shall be exposed to the exterior of the unit. Self-tapping screws are not acceptable due to their inherent inability to maintain torque over the life of the product.
9. To provide a cleanable internal finish and ensure a long product life, all internal wall surfaces shall be painted with a glossy white baked on powder coating.
10. To prevent internal cabinet corrosion, all air-side panel joints shall include a SOLID VAPOR BARRIER thereby preventing moisture migration into the wall space. The internal seal shall be resistant to pressure wash down cycles.
11. The cabinets' external panels shall be 18 gauge solid galvanized steel.
12. The cabinets' internal panels shall be 20 gauge solid galvanized steel.
13. The panel system shall have been tested by an independent certified laboratory using ASTM method Test for Sound Transmission Loss obtained using procedures conforming to ASTM designations E90-09.

FREQUENCY/HZ	125	250	500	1000	2000	4000
TRANSMISSION LOSS	21	23	20	33	47	51

SOUND TRANSMISSION (STC): 28

14. Outdoor unit weatherproofing

The roof weatherproofing system shall be independently constructed from the cabinet air seal, thereby providing an independent structure from the pressure seals. To allow for water drainage, the roof panel system shall be sloped at least $\frac{1}{4}$ " per foot. The interstitial space shall be vented through a perimeter soffit. Multiple slopes are required for AHU's having widths larger than 128 inches. The roof perimeter shall have a 1 inch overhung with a built-in water deflector. The water deflector is designed to minimize water run-down the vertical side walls. All doors shall be equipped with water deflector gutters.

G. ACCESS DOORS

1. Access doors shall be provided as shown on plans. Generally on the side with access to the mechanical drive and piping side of the air handling unit. All access doors exposed to the weather shall have rain gutters to prevent water from running down on the door framing system.
2. Door panels shall be made with two shells inter-connected to each other with High Density Polyethylene (HDPE) in order to ensure a complete NO-THROUGH-METAL assembly.
3. The door panels shall be double wall. To prevent air leakage and provide a rigid design, the external skin shall include all the forming segments of the double gasket base support. The door frame shall be made of a dual heavy gauge galvanized steel and shall be bolted to the cabinet wall panels. To reduce conductivity through the door framing system, the door frames shall have a complete NO-THROUGH-METAL break consistent with the rest of the cabinet.
4. Each access door shall be equipped with at least two stainless steel hinges and two latches which shall be operable from the inside and outside of the unit. The handles shall be easy to operate and be made of fiberglass reinforced with nylon.
5. The air seal between the door and its frame shall be accomplished with single neoprene bulb gaskets. The gaskets shall be bonded with a high quality adhesive agent. The gasket system is designed to provide a solid contact providing a high level of thermal resistance. The gaskets shall be continuous with single bonded joints.
6. Access door sizes and orientation shall be as indicate on drawings. Doors shall open against pressure; positive-open in, negative-open out.
7. Each door shall include double pane thermal glass window, a minimum of 10 inches x 10 inches, installed at eye level and properly sealed to operate safely against suction or pressure conditions.
8. All access doors shall have built-in static pressure ports for ease of reading static pressure across internal components and limit unnecessary or unauthorized access inside the unit. Pressure test ports shall be Dynair PTP-1.
9. Doors shall be a minimum 2.0" thick and be insulated with polyurethane foam having an R-value equal to 13.
10. Finish shall be similar to unit casing finish.

H. AUXILIARY FLOOR DRAIN AND DRAIN PANS

1. Provide Multi-sloped recessed floors with auxiliary threaded pipe drain connections in the air handler floor sections as indicated on the plans. The connection material shall be the same as the internal section floor surface. The drain pipes must be welded to catch basins equipped with removable gratings.
2. Floor drain shall be exterior insulated, piped by Division 22 00 00.

I. EXTERIOR POWDER COATING FINISH

1. The exterior surfaces of the air handler shall be powder coated.
 - a. The powder coating process shall include: Pre-washing; Rinsing; Re-washing; Rinsing cycle I; Rinsing cycle II; Oven dry @ 400 deg F; Electrostatic paint application (powder format); Baked finish @ 400 deg F.
 - b. Paint shall be applied in an electrostatic powder coating system. The electrostatic spraying shall be accomplished by applying an electrical charge to the dry powder particles while the component to be painted is electrically grounded. The charged powder and grounded workpiece create an electrostatic field that pulls the paint particles to the workpiece. The coating deposited on the workpiece retains its charge, which holds the powder to the workpiece. The coated workpiece is placed in a curing oven, where the paint particles are melted onto the surface and the charge is dissipated. The paint system shall be environmentally friendly, therefore eliminating the use of volatile organic compounds (VOC's), hazardous air pollutants (HAP's) and solvents. Individual panels must be painted prior to final assembly to ensure painting of all sheared metal edges and concealed surfaces. The paint coating shall resist 5000 hours to the standard ASTM-B117 salt spray test.

J. ELECTRICAL

1. **Fluorescent fixtures:** Light fixtures shall be "EMERGI-LITE" IPETM series IP65 Surface mounting vapor-tight, 1.2 m (4') long fixture with two 32 watt lamps (T8), rapid start high efficiency electronic ballasts, CSA certified. The body and lens shall be constructed of UV stabilized industrial grade vandal resistant polycarbonate. A durable formed gasket shall be provided between the enclosure and the lens and shall be designed specifically for hostile environments. The reflector shall be made of highly specular material and formed to maximize light output efficiency. All parts shall be corrosion resistant. A metal plate used to retain the ballast and reflector also serves to dissipate heat, therefore lengthening ballast life.
2. **Switches:** Hubbell RC109W, CSA certified, 15 amps, 120 volt AC. Single pole Switch, illuminated pilot light, self grounding, side wire termination. Unless otherwise shown or specified, connect all air handling unit lighting fixtures to one switch. Junction box shall be "THOMAS & BETTS" universal FSU – 2 3/8" deep, cast aluminum and supplied with close-up plugs. Cover plate shall be made of stamped aluminum.

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3. **Wiring and Conduit:** The unit wiring shall be stranded copper wire sheathed in a THHN covering, which will be distributed through the unit in EMT conduit; the use of aluminum wire or BX cable is prohibited. To allow for adjustment of fan motors, a 3'-0" section of weatherproof flex connect shall be provided at each motor. A separate ground wire for each motor shall be connected to a terminal in the disconnect switch. In addition to the requirements herein, wiring shall comply with NEC requirements. Inter-modular wiring shall terminate in a coiled configuration at the end of each module. The contractor shall pull the cables through the modules to complete the system wiring.
 4. All power wiring shall be in accordance with NEC and local code requirements.
 5. Lighting fixtures and service switches shall be on separate circuits than chilled water pump equipment.

2.33 AUTOMATIC TEMPERATURE CONTROLS (Refer to SECTION 019113 and 230800 COMMISSIONING for additional contract requirements)

A. Basic Components and Systems:

1. General: Provide control products in sizes and capacities indicated, consisting of dampers, thermostats, clocks, sensors, controllers, and other components as required for completed installation. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their product information, designed and constructed as recommended by manufacturer and as required for application indicated. All equipment and systems shall be installed by factory trained contractors with the following functional and construction features.
2. The building automation system shall be based on the latest version (Version 4) of Tridium Niagara platform and shall be on an open protocol BACnet system infrastructure that integrates diverse systems and devices (regardless of manufacturer, communication standard ie BACnet, Lon, Modbus or software) into a unified platform that can be read and written to and easily managed in real time using a standard Web browser. Systems not developed on a Tridium Niagara N4 platform with BACnet protocol are unacceptable. The building automation system shall not require licensing fees and shall be licensed indefinitely to the Owner for use at the project site with all required programming software tools.
3. The Building Management System (BMS) shall be an extension of the City of Framingham school building energy management system, as currently maintained by American Energy Management (AEM). Project ATC Contractor shall provide a SEAMLESS tie-in and integration to the existing School Building BMS Central Server. The tie-in shall include Direct Digital Control (DDC), historical data collection, archiving, alarm, energy and information management for all control points specified herein and on the drawings. ATC Contractor shall provide new animated graphics for all new equipment and systems on the server.
4. ATC manufacturer shall provide written confirmation that installing ATC Contractor is an authorized dealer and service provider. The ATC system provided must be capable of being serviced by three or more local authorized vendors/contractors.
5. Provide all required control wiring including CAT6 Ethernet wiring for all controllers requiring Ethernet connectivity BACNet-IP connections, BACNet

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- MSTP is prohibited on any ATC Controller including field and terminal controllers. Terminate Ethernet cable in MDF and IDF closets on patch panels proceed under Technology Section 270000.
6. Install an open-protocol (BACnet) energy management system (EMS) to monitor and trend the energy consumed by the following systems throughout the school:
 - a. HVAC systems
 - b. Hot and cold domestic water systems
 - c. Electric service meters
 - d. Gas meters
 7. The ATC control and building EMS system shall have the following attributes with characteristics and performance as specified within this Specification section, related Electrical and Plumbing section specifications and the Control Diagram drawings:
 - a. Sensors as follows:
 - 1) Sensors to trend outdoor air temperature
 - 2) Indication and trending of damper and valve commanded positions.
 - 3) Sensors to monitor building electrical and natural gas consumption. Electrical meters shall be provided by the Electrical Contractor and control wiring from the meters to the EMS system shall be provided by the ATC contractor. Gas meters shall be furnished and installed by the Plumbing contractor. The ATC contractor shall provide control wiring from the meters to the BMS. Flow meters for building cold water consumption will be installed by the Plumbing Contractor and furnished and wired to the BMS by the ATC Contractor. Domestic hot water shall be relays on each domestic water heater burner and through BMS programming utilizing burner on/off operation domestic hot water consumption will be determined, all provided by the ATC Contractor.
 - 4) Sensors to monitor indoor and outdoor CO2.
 - 5) Sensors to monitor and trend (create trend logs) controlled variables at the operator interface. Control variables may include air and/or water flow, temperature, pressure, CO2, and pump or fan speed. Relevant multiplexed data from microprocessors located in chillers, boilers, variable speed drives and other equipment with multiplexing capabilities may be used in lieu of specifying separate sensors.
 - 6) All densely occupied spaces, with occupant density of 25 people or more per 1000 s.f. must be provided with CO2 sensors per LEED IEQC1 requirements. Provide multi functioning sensors with temperature, humidity and CO2 for all spaces except for storage rooms and toilet rooms.
 - b. Points matrix – including all hardwired input and output devices connected to the automation system, all set points, upper and lower control limits.
 - c. Trend capabilities – including a trend point list and preprogrammed sample of point (performed by controls contractor), sample rate, storage interval, upload interval, custom trend abilities, alarms, and automated trend data review and notification (automated diagnostics).

- d. System architecture – capable of allowing sampling of these points to facilitate building commissioning and diagnostics without significantly affecting system performance.
 - e. Data storage system – with adequate capacity to record trend data for use by building operators. Data export requirements must facilitate user-friendly data access and manipulation.
 - f. Operator interface – designed for remote/web access, monitoring requirements, trend-log reporting and diagnosing building problems through a user-friendly interface. This includes providing a visual (non text based) operations and reporting interface to facilitate rapid system assessment that utilizes color-coding, diagrams of floor plans and graphing capabilities.
 - g. The remote access shall use a web browser only and not require a VPN with remote desktop application.
8. Electric Wiring: All electric wiring and wiring connections, either line voltage or low voltage, from the emergency electric panels to the ATC panels, and from the ATC related panels to the individual control devices i.e. rooftop units, exhaust fans, boilers, chillers, valves, and dampers required for the installation of the control system, as herein specified shall be provided by the control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications.
- a. The wiring installation shall be in accordance with National and Local Codes and with the Electrical portion of these specifications. All wiring shall be run concealed wherever possible. Exposed wiring in occupied areas shall be run in raceways. Raceways shall be Wiremold 200 series with all elbows, raceways, covers, mounting stops, box extensions and wiring for a complete and neat installation. All wiring located in mechanical spaces, boiler rooms, and fan rooms shall be installed in metal conduit
 - b. All wiring above ceilings, in boiler rooms, and all mechanical spaces shall follow routing of piping and where not possible shall be in conduit. All exposed wire shall be bundled and wire tied and shall be supported to adjacent piping. Draped and free floating wire will not be allowed.
 - c. All terminations of wire at control devices shall be looped and supported adequately.
 - d. All wiring shall comply with the requirements of the electrical section of the specification.
- B. Controls Systems Wiring
1. All conduit raceways, wiring, accessories and wiring connections required for the installation of the Controls Systems shall be provided by the Controls Contractor except as shown on the Electrical Drawings. All wiring shall comply with the requirements of applicable portions of the Electrical Section 260010 and all local and national electric codes and the requirements of the AHJ.
 2. All Controls Systems wiring materials and installation methods shall comply with the original equipment manufacturer recommendations and standards.
 3. The sizing type and provision of cable, conduit, cable trays and raceways shall be the design responsibility of the Controls Contractor.
 4. Class 2 Wiring

- a. All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
 - b. Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5ft. from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines.
 5. Class 2 signal wiring and 24VAC power may be run in the same conduit. Power wiring 120VAC and greater shall not share the same conduit with Class 2 signal wiring.
 6. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
 - a. All circuits are continuous and free from short circuits and grounds.
 - b. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megaohms.
 - c. All circuits are free from induced voltages.
 7. Provide complete testing for all cables and wiring. Provide all equipment, tools, and personnel as necessary to conduct these tests.
 8. Provide for complete grounding of all signal and communication cables, panels and equipment so as to ensure integrity of Controls Systems operation. Ground cabling and conduit at panel terminations. Do not create ground loops.
- C. Line Voltage Power Sources
1. 120-volt AC circuits for the Controls Systems shall be taken by the Controls Contractor from electrical emergency panelboards and circuit breakers as designated on the electrical drawings.
 2. Circuits used for the Controls Systems shall be dedicated to these Controls Systems and shall not be used for any other services.
 3. Controls DDC terminal unit controllers may use 120-volt AC power from motor power circuits.
- D. Controls Systems Raceways
1. All wiring shall be installed in conduit or raceway except as noted elsewhere in the Specification. Minimum conduit size 3/4 in.
 2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
 3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the supporting surface.
 4. UL/ULC Listed Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 ft. in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls and for final connection to equipment.
- E. Penetrations
1. Firestopping for all penetrations used by dedicated Controls Systems conduits and raceways shall be by other trades.

2. All openings in fire proofed or fire stopped components shall be closed by other trades using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls, shall be in sleeves, conduit or enclosed raceway.
4. No penetrations through building structural elements, slabs, ceilings and walls shall be made before receipt of written approval from the Architect.

F. Controls Systems Identification Standards

1. Node Identification: All nodes shall be identified by a permanent label fastened to the outside of the enclosure. Labels shall be suitable for the node environmental location.
2. Cable shall be labeled at every termination with cross-referencing to record documentation.
3. Raceway Identification: Exposed covers to junction and pull boxes of the FMS raceways shall be identified at primary points.
4. Wire Identification: All low and line voltage wiring shall be identified by a number, as referenced to the associated shop and record drawing, at each termination.
5. Wires and cabling shall not be spliced between terminations. Cable shields shall be single end grounded – typically at the panel end outside the panel.
6. Suggested color coding, for use at the Contractors option, are:
 - a. Analog Input Cable Yellow
 - b. Analog Output Cable Tan
 - c. Binary Input Cable Orange
 - d. Binary Output Cable Violet
 - e. 24 VAC Cable Gray
 - f. General Purpose Cable Natural
 - g. Tier 1 Comm Cable Purple
 - h. Other Tier Comm Cable Blue
 - i. Ethernet cable Blue
7. Provide permanent identification labels at all valve and damper actuators to indicate open and closed positions.

G. Field Panel And Device Installations And Locations

1. The Controls Systems panels, enclosures and cabinets shall be located as coordinated with the Architect at an elevation of not less than 2 ft. from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. All field devices shall be installed per the manufacturer recommendation and in accessible locations as coordinated with the Architect.
3. Panels to be located in damp areas or areas subject to condensation shall be mounted with wall standoffs.
4. Conduit configurations entering or leaving panels and devices shall be such as to preclude condensation traps.

H. Networking Communications

1. The design of the BAS shall network operator workstations and stand-alone DDC Controllers. The network architecture shall consist of multiple levels for communication efficiency, a campus-wide (Management Level Network) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.
2. System shall communicate with a BACnet network over Ethernet using BACnet/IP (according to Annex J). The intent is to use the system provided under this contract to communicate with control systems and/or devices provided by other vendors. A BAS system submittal including diagrams indicating all PICS, NIC, Controllers, and Wiring shall be provided describing the BACnet, ANSI/ASHRAE 135-95, implementation. The product shall be Network Application Engine level 1 controllers with field equipment controller for level 2 controllers no substitutions. Minimum system functionality must include monitoring, commanding, and alarming for daily operator functions from a common workstation.
 - a. System shall have the capability to be an OPC Client and Server for dynamic communication with OPC Clients or Servers over an Ethernet network. At a minimum, the following must be supported:
 - 1) Data Access 1.0 (96), 1.0A (97) and 2.0 (11/98)
 - 2) Alarms & Events 1.0 (1/99)
3. Network Switches
 - a. Provide HP ProCurve 2910 al series 2910-48G al 48 ports network switch Brocade, Cisco or equal in MDF/IDF rooms as required.
4. Ethernet Wiring
 - a. Ethernet wiring shall be CAT6 UTP cable plenum rated. CAT6 UTP cables shall conform to ANSI/TIA/EIA-568-B1, B2, B3 Commercial Building Telecommunications Cabling Standard (latest amendment and including all applicable addenda) and ISO/IEC 11801 (International) Generic Cabling for Customer Premises standard (latest amendment and including all applicable addenda).
5. Building Data Network:
 - a. All operator devices either network resident shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.
 - b. The network shall support a minimum of 100 DDC controllers and PC workstations
 - c. The system shall support integration of third party systems (fire alarm, security, lighting, PLC, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.

- d. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.
 - e. The Building Network shall use the TCP/IP over Ethernet. All devices must:
 - 1) Auto-sense 10/100/1000 Mbps networks.
 - 2) IP Address will be assigned by Owner's IT staff.
 - 3) DNS and Gateway IP address will be provided by Owner's IT staff. A VLAN will be setup by Owner's IT staff.
 - 4) Allow access using Telnet.
6. Internet access
- a. Web Based Operator Interface
 - 1) The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.
 - 2) All information exchanged over Internet shall be encrypted and secure via SSL.
 - 3) Access to the web interface will be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users "read" access via the web browser, while maintaining "command" privileges via the BAS workstation.
 - 4) Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.
 - 5) The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
 - a) Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
 - b) Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.

- c) Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated “web” graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
 - d) Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
 - e) Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.
- 7. The web server licensing options will allow concurrent access by 10 browser connections.
 - 8. Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.
- I. DDC Controller Floor Level 2 Network
 - 1. This level communication shall support a family of application specific controllers and shall communicate with the network through DDC Controllers for transmission of global data.
 - J. DDC & HVAC Mechanical Equipment Controllers
 - 1. The DDC and HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.
 - 2. DDC and HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC and HVAC Mechanical Equipment Controllers which require different programming language or tools on a network are not acceptable.
 - 3. DDC and HVAC Mechanical Equipment Controllers which do not meet the functions specified are not acceptable.
 - K. DDC Controllers
 - 1. DDC Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three Floor Level Application Specific Controller Device Networks.

2. Each DDC Controller shall have 72 512 Megabytes of memory with ECY and include 4 GB flash memory to support its own operating system and databases, including:
 - a. Control processes
 - b. Energy management applications
 - c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - d. Historical/trend data for points specified
 - e. Maintenance support applications
 - f. Custom processes
 - g. Operator I/O
 - h. Dial-up communications
 - i. Manual override control using WAP for commissioning purpose
3. Each DDC Controller shall support firmware upgrades without the need to replace hardware.
4. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
5. DDC Controllers shall provide a RS-485 serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.
6. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
 - a. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 - b. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
7. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
8. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

9. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:
 - a. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
 - b. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
 - c. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
 - d. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)
 - e. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:
 - 1) IEEE Standard 587-1980
 - 2) UL 864 Supply Line Transients
 - 3) Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)
10. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.
 - a. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
 - b. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
11. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

L. HVAC Mechanical Equipment Controllers

1. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.
2. Each HVAC Mechanical Controller shall have 72 Megabytes of memory to support its own operating system and databases, including:
 - a. Control processes
 - b. Energy management applications
 - c. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
 - d. Historical/trend data for points specified
 - e. Maintenance support applications
 - f. Custom processes
 - g. Operator I/O
 - h. Remote communications

3. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.
4. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.
5. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.
6. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - a. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.
 - b. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

M. DDC and HVAC Mechanical Equipment Controller Resident Software Features

1. General:
 - a. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.
 - b. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.
 - c. All digital points shall have user defined two-state status indication (descriptors with minimum of eight characters allowed per state (i.e. summer/winter).
2. Control Software Description:
 - a. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre-tested control algorithms:
 - 1) Two-position control
 - 2) Proportional control
 - 3) Proportional plus integral control
 - 4) Proportional, integral, plus derivative control
 - 5) Automatic tuning of control loops

3. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.
 - a. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.
 - 1) The SSTO program shall operate in both the heating and cooling seasons.
 - a) It shall be possible to apply the SSTO program to individual fan systems.
 - b) The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.
 - 2) The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.
 - b. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.
 - 1) It shall be possible to individually command a point or group of points.
 - 2) For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.
 - 3) The operator shall be able to define the following information:
 - a) Time, day
 - b) Commands such as on, off, auto, and so forth.
 - c) Time delays between successive commands.
 - d) There shall be provisions for manual overriding of each schedule by an appropriate operator.
 - 4) It shall be possible to schedule events up to one year in advance.
 - a) Scheduling shall be calendar based.
 - b) Holidays shall allow for different schedules.
 - c) Enthalpy switchover (economizer) The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature and will be able to override the economizer cycle and return to minimum outside air operation at any time.

- d) Temperature-compensated duty cycling.
 - The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.
 - The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.
 - e) Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.
 - f) Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.
 - g) The Peak Demand Limiting (PDL) program shall limit the consumption of electricity to prevent electrical peak demand charges.
 - PDL shall continuously track the amount of electricity being consumed, by monitoring one or more electrical kilowatt-hour/demand meters. These meters may measure the electrical consumption (kWh), electrical demand (kW), or both.
 - PDL shall sample the meter data to continuously forecast the demand likely to be used during successive time intervals.
 - If the PDL forecasted demand indicates that electricity usage is likely to exceed a user preset maximum allowable level, then PDL shall automatically shed electrical loads.
 - Once the demand peak has passed, loads that have been shed shall be restored and returned to normal control.
4. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- a. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.
 - b. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 - c. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.
 - d. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.

5. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.
 - a. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 - b. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 - c. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.
 - d. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.
 - e. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.
6. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.
 - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of 1 minute to seven days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a sufficient number of data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

- b. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
 - 1) Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
 7. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.
 8. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.
 9. The network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.
- N. Floor Level Network Application Specific Controllers (FEC)
1. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (FECs) through Floor Level LAN Device Networks.
 2. Each FEC shall operate as a stand alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each FEC shall be a microprocessor based, multi tasking, real time digital control processor. Each FEC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.
 3. Terminal Equipment Controllers:
 - a. Provide for control of each piece of equipment, including, but not limited to, the following:
 - 1) Exhaust Fans

- 2) Fin Tube Radiation
 - 3) Convectors
 - 4) Radiant Heating Panels
 - 5) Unit Heaters, Cabinet Unit Heaters
 - b. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v, allowing for interface to a variety of modulating actuators.
 - c. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable.
- O. Local User Display
1. Where specified in the sequence of operation or points list, the controllers on the peer to peer building level network shall have a display and keypad for local interface. A keypad shall be provided for interrogating and commanding points in the controller.
 2. The display shall use the same security password and access rights for points in the display as is used in the associated controller.
 3. The LCD display shall be a minimum of a 2 line 40 character display.
 4. The LCD display shall include the full point name, value (numeric, digital or state text),
 5. point priority and alarm status on one screen.
 6. The LCD shall dynamically update the value, priority, and alarm status for the point being displayed.
 7. The display shall be mounted either on the door of the enclosure or remote from the controller.
- P. Personal Computer Operator Workstation Hardware
1. Personal computer operator workstations shall be provided for command entry, information management, system monitor, alarm management and database management functions. All real-time control functions shall be resident in the DDC Controllers to facilitate greater distribution, fault tolerance and reliability of the building automation control.
 - a. Provide workstation(s): Manufactured by Dell, HP, Lenovo or equal.
 - b. Workstation shall consist of a personal computer with minimum 10.0GB RAM, hard drive with 2 TB available space, video card capable of supporting 1024 x 768 resolution with a minimum of 32 Bit color (Windows 10), DVD-ROM Drive, mouse and 101-key enhanced keyboard. Personal computer shall be a Windows 10 Compatible PC and shall include a minimum latest generation Intel Core i7 3.40 GHz processor.
 - c. The PC monitor shall support a minimum display resolution of no less than 1900 X 1280 pixels and shall be minimum 19 in. LCD display. Separate controls shall be provided for color, contrasts and brightness. The screen shall be non-reflective.

- d. Also provide separate file server with available storage capacity to accommodate trending 15 min. interval of each control point for a period of one year for data archives, minimum 1 TB capacity.
2. Provide an HP LaserJet Pro 400 Color M451dn, Cannon, Brother or equal printer at each workstation location or on the network (Ethernet) for recording alarms, operator transactions and systems reports.
3. Alarm Display shall list the alarms with highest priority at the top of the display. The alarm display shall provide selector buttons for display of the associated point graphic and message. The alarm display shall provide a mechanism for the operator to sort alarms.
4. Intranet/Internet access
 - a. Web Based Operator Interface
 - 1) The BAS shall provide a web based graphical interface that allows users to access the BAS data via the Internet, extranet, or Intranet. The interface shall use HTML based ASP pages to send and receive data from the BAS to a web browser.
 - 2) A web server computer will be supplied. The web server shall support browser access via Microsoft Internet Explorer 9.0 (or higher), or Navigator Netscape 6.0 (or higher).
 - 3) All information exchanged over Internet shall be optionally encrypted and secure via SSL (provided by Owner).
 - 4) Access to the web interface may be password protected. A users rights and privileges to points and graphics will be the same as those assigned at the BAS workstation. An option will exist to only allow users "read" access via the web browser, while maintaining "command" privileges via the BAS workstation.
 - 5) Commissioning of the Web interface shall not require modification or creation of HTML or ASP pages. All graphics available at the BAS graphical workstation shall be available to users via a web browser.
 - 6) The web-based interface shall provide the following functionality to users, based on their access and privilege rights:
 - a) Logon Screen – allows the user to enter their user name, password and Domain name for logging into the web server.
 - b) Alarm Display – a display of current BAS alarms to which the user has access will be displayed. Users will be able to acknowledge and erase active alarms, and link to additional alarm information including alarm messages, and informational and memo text. Any alarm acknowledgements initiated through the web interface will be written to the BAS central workstation activity log.

- c) Graphic Display – Display of system graphics, including animated motion, available in the BAS workstation will be available for viewing over the web browser. Software that requires creation of dedicated “web” graphics in order to display them via the browser interface will not be acceptable. A graphic selector list will allow users to select any graphics to which they have access. Graphic displays will automatically refresh with the latest change of values. Users will have the ability to command and override points from the graphic display as determined by their user accounts rights.
 - d) Point details – users will have access to point detail information including operational status, operational priority, physical address, and alarm limits, for point objects to which they have access rights.
 - e) Point Commanding – users will be able to override and command points they have access to via the web browser interface. Any commands or overrides initiated via the web browser interface will be written to the BAS central workstation activity log.
- 7) The web server licensing options will allow concurrent access by a minimum of 10 browser connections.
 - 8) Internet connections, ISP services, as well as necessary firewalls or proxy servers shall be provided by the Owner as required to support the web access feature.

Q. Operators Laptop

- 1. A Lap Top Operators Terminal shall be provided for operator readout of system variables, override control and adjustment of control parameters and display graphics as called for in paragraphs following. Computer specification shall be similar to fixed station computer in Paragraph Q.
- 2. Functionality to include ability to automatically display a sequential all point summary and a sequential alarm summary. The Lap Top shall also allow display and/or changing of digital point state, analog point value, time and date, application and DDC parameters, analog limits, time schedules, runtime counts and limits, daylight savings time changeover, time/event initiation, and programmable offset values. The Lap Top shall allow access into DCP initialization routines and diagnostics and enable/disable of points, initiators and programs, all similar to the fixed computer. Laptop shall have a minimum 15 in. color screen, 4GB ram, 500GB hard drive and Windows 10 Professional operating system.

R. Workstation Operator Interface

1. Basic Interface Description

- a. Operator workstation interface software shall minimize operator training through the use of user-friendly and interactive graphical applications, 30-character English language point identification, on-line help, and industry standard Windows application software. Interface software shall simultaneously communicate with existing system and share data between the dedicated, modem autodial, and Ethernet-connected building level networks. The software shall provide, as a minimum, the following functionality:
- 1) Real-time graphical viewing and control of the BAS environment
 - 2) Reporting
 - 3) Scheduling and override of building operations
 - 4) Collection and analysis of historical data
 - 5) Point database editing, storage and downloading of controller databases.
 - 6) Utility for combining points into logical Point Groups. The Point Groups shall then be manipulated in Graphics, trend graphs and reports in order to streamline the navigation and usability of the system.
 - 7) Alarm reporting, routing, messaging, and acknowledgment
 - 8) "Collapsible tree," dynamic system architecture diagram application:
 - a) Showing the real-time status and definition details of all workstations and devices on a management level network
 - b) Showing the real-time status and definition details of all DDC and HVAC Mechanical Controllers at the building level
 - c) Showing the status and definition details of all field-level application controllers
 - 9) Definition and construction of dynamic color graphic displays.
 - 10) Online, context-sensitive help, including an index, glossary of terms, and the capability to search help via keyword or phrase.
 - 11) On-screen access to User Documentation, via online help or PDF-format electronic file.
 - 12) Automatic database backup at the workstation for database changes initiated at DDC Controller operator interface terminals.
- b. Provide a graphical user interface that shall minimize the use of keyboard through the use of a mouse or similar pointing device, with a "point and click" approach to menu selection and a "drag and drop" approach to inter-application navigation. Selection of applications within the workstation software shall be via a graphical toolbar menu – the application toolbar menu shall have the option to be located in a docked position on any of the four sides of the visible desktop space on the workstation display monitor, and the option to automatically hide itself from the visible monitor workspace when not being actively manipulated by the user.

- c. The software shall provide a multi-tasking type environment that allows the user to run several applications simultaneously. BAS software shall run on a Windows 7 Professional bit operating system. System database parameters shall be stored within an object-oriented database, which is compliant with the Open Database Connectivity (ODBC) or Structured Query Language (SQL) standards. Standard Windows applications shall run simultaneously with the BAS software. The mouse or Alt-Tab keys shall be used to quickly select and switch between multiple applications. The operator shall be able to work in Microsoft Word, Excel, and other Windows based software packages, while concurrently annunciating on-line BAS alarms and monitoring information
 - 1) Provide functionality such that any of the following may be performed simultaneously on-line, and in any combination, via adjustable user-sized windows. Operator shall be able to drag and drop information between the following applications, reducing the number of steps to perform a desired function (e.g., Click on a point on the alarm screen and drag it to the dynamic trend graph application to initiate a dynamic trend on the desired point):
 - a) Dynamic color graphics application
 - b) Alarm management application
 - c) Scheduling application
 - d) Dynamic trend graph data plotter application
 - e) Dynamic system architecture diagram application
 - f) Control Program and Point database editing applications
 - g) Reporting applications
 - 2) Report and alarm printing shall be accomplished via Windows Print Manager, allowing use of network printers.
- d. Operator-specific password access protection shall be provided to allow the administrator/manager to limit users' workstation control, display and data base manipulation capabilities as deemed appropriate for each user, based upon an assigned password. Operator privileges shall "follow" the operator to any workstation logged onto (up to 999 user accounts shall be supported). The administrator/manager shall be able to grant discrete levels of access and privileges, per user, for each point, graphic, report, schedule, and BAS workstation application. And each BAS workstation user account shall use a Windows 10 user account as a foundation.
- e. Dynamic Color Graphics application shall include the following:
 - 1) Must include graphic editing and modifying capabilities
 - 2) A library of standard control application graphics and symbols must be included
 - 3) Must be able to command points directly off graphics application
 - 4) Graphic display shall include the ability to depict real-time point values dynamically with animation, picture/frame control, symbol association, or dynamic informational text-blocks.

- 5) Navigation through various graphic screens shall be optionally achieved through a hierarchical "tree" structure
 - 6) Graphics viewing shall include zoom capabilities
 - 7) Graphics shall automatically display the HAND status of points that have been overridden by a field HAND switch, for points that have been designed to provide a field HAND override capability.
 - 8) Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
- f. Reports shall be generated on demand or via pre-defined schedule, and directed to CRT displays, printers or file. As a minimum, the system shall allow the user to easily obtain the following types of reports:
- 1) A general listing of all or selected points in the network
 - 2) List of all points currently in alarm
 - 3) List of all points currently in override status
 - 4) List of all disabled points
 - 5) List of all points currently locked out
 - 6) List of user accounts and access levels
 - 7) List all weekly schedules and events
 - 8) List of holiday programming
 - 9) List of control limits and deadbands
 - 10) Custom reports from 3rd party software
 - 11) System diagnostic reports including, list of DDC panels on line and communicating, status of all DDC terminal unit device points
 - 12) List of programs
 - 13) List of point definitions
 - 14) List of logical point groups
 - 15) List of alarm strategy definitions
 - 16) List of DDC Control panels
 - 17) Point totalization report
 - 18) Point Trend data listings
 - 19) Initial Values report
 - 20) User activity report
- g. Scheduling and override

- h. Provide a calendar type format for simplification of time and date scheduling and overrides of building operations. Schedule definitions reside in the PC workstation, DDC Controller, and HVAC Mechanical Equipment Controller to ensure time equipment scheduling when PC is off-line -- PC is not required to execute time scheduling. Provide override access through menu selection, graphical mouse action or function key. Provide the following capabilities as a minimum:
 - 1) Weekly schedules
 - 2) Zone schedules
 - 3) Event schedules – an event consists of logical combinations of equipment and/or zones
 - 4) Report schedules
 - 5) Ability to schedule for a minimum of up to 365 days in advance
 - 6) Additionally, the scheduling application shall:
 - a) Provide filtering capabilities of schedules, based on name, time, frequency, and schedule type (event, zone, report)
 - b) Provide sorting capabilities of schedules, based on name, time and type of schedule (zone, event, report)
 - c) Provide searching capabilities of schedules based on name – with wildcarding options
- i. Collection and Analysis of Historical Data
 - 1) Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period of time. Any system point may be trended automatically at time-based intervals (up to four time-based definitions per point) or change of value, both of which shall be user-definable. Trend data shall be collected stored on hard disk for future diagnostics and reporting. Automatic Trend collection may be scheduled at regular intervals through the same scheduling interface as used for scheduling of zones, events, and reports. Additionally, trend data may be archived to network drives or removable disk media for future retrieval.
 - 2) Trend data reports shall be provided to allow the user to view all trended point data. Reports may be customized to include individual points or predefined groups of selected points. Provide additional functionality to allow predefined groups of up to 250 trended points to be easily transferred on-line to Microsoft Excel. DDC contractor shall provide custom designed spreadsheet reports for use by the owner to track energy usage and cost, equipment run times, equipment efficiency, and/or building environmental conditions. DDC contractor shall provide setup of custom reports including creation of data format templates for monthly or weekly reports.
- j. The ATC contractor shall provide an additional 80 hours of ATC/BMS system programming time to assist the owner/engineer with customized programming of the ATC/BMS system due to any changes and/or modifications.

2. Dynamic Color Graphic Displays

- a. Create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units and hot water boiler systems, and room level terminal units, shall be provided by the BAS contractor as indicated in the point I/O schedule of this specification to optimize system performance, analysis and speed alarm recognition.
- b. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.
- c. Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.
 - 1) Provide the user the ability to display real-time point values by animated motion or custom picture control visual representation. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. A library (set) of animation and picture control symbols shall be included within the workstation software's graphics application. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.
 - 2) Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint.
 - 3) Provide the user the ability to display blocks of point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.
 - 4) Equipment state or values can be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.
 - 5) State text for digital points can be user-defined up to eight characters.
- d. Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable.
- e. Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls), internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.
- f. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

- g. Off the shelf graphic software, html web-based graphic software shall be provided to allow the user to add, modify or delete system graphic background displays.
 - h. A clipart library of HVAC application and automation symbols shall be provided including fans, valves, motors, chillers, AHU systems, standard ductwork diagrams. The user shall have the ability to add custom symbols to the clipart library. The clipart library shall include a minimum of 400 application symbols. In addition, a library consisting of a minimum of 700 graphic background templates shall be provided.
 - i. The Graphics application shall include a set of standard Terminal Equipment controller application-specific background graphic templates. Templates shall provide the automatic display of a selected Terminal Equipment controller's control values and parameters, without the need to create separate and individual graphic files for each controller.
3. System Configuration & Definition
- a. A "Collapsible tree," dynamic system architecture diagram/display application of the site-specific BAS architecture showing status of controllers, PC workstations and networks shall be provided. This application shall include the ability to add and configure workstations, DDC Controllers or HVAC Mechanical Equipment controllers, as well as 3rd-party integrated components. Symbols/icons representing the system architecture components shall be user-configurable and customizable, and a library of customized icons representing 3rd-party integration solutions shall be included. This application shall also include the functionality for real-time display, configuration and diagnostics of dial-up modems to DDC Controllers.
 - b. Network wide control strategies shall not be restricted to a single DDC Controller or HVAC Mechanical Equipment controller, but shall be able to include data from any and all other network panels to allow the development of Global control strategies.
 - c. Provide automatic backup and restore of all DDC controller and HVAC Mechanical Equipment controller databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate DDC Controller or HVAC Mechanical Equipment Controller. Changes made at the user-interface of DDC Controllers or HVAC Mechanical Equipment Controllers shall be automatically uploaded to the workstation, ensuring system continuity.
 - d. System configuration, programming, editing, graphics generation shall be performed on-line. If programming and system back-up must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.

- e. Point database configuration shall be available to the user within a dedicated point database editor application included in the workstation software. The editor shall allow the user to create, view existing, modify, copy, and delete points from the database. The point editor shall also allow the user to configure the alarm management strategy for each point. The editor shall provide the option for editing the point database in an online or offline mode with the DDC Controllers.
 - 1) The workstation software shall also provide the capability to perform bulk modification of point definition attributes to a single or multiple user-selected points. This function shall allow the user to choose the properties to copy from a selected point to another point or set of points. The selectable attributes shall include, but are not limited to, Alarm management definitions and Trend definitions.
4. Alarm Management
- a. Alarm Routing shall allow the user to send alarm notification to selected printers or workstation location(s) based on time of day, alarm severity, or point type.
 - b. Alarm Notification shall be presented to each workstation in a tabular format application, and shall include the following information for each alarm point: name, value, alarm time and date, alarm status, priority, acknowledgement information, and alarm count. Each alarm point or priority shall have the ability to sound a discrete audible notification.
 - c. Alarm Display shall have the ability to list and sort the alarms based on alarm status, point name, ascending or descending alarm time.
 - d. Directly from the Alarm Display, the user shall have the ability to acknowledge, silence the alarm sound, print, or erase each alarm. The interface shall also have the option to inhibit the erasing of active acknowledged alarms, until they have returned to normal status. The user shall also have the ability to command, launch an associated graphic or trended graphical plot, or run a report on a selected alarm point directly on the Alarm Display.
 - e. Each alarm point shall have a direct link from the Alarm Display to further user-defined point informational data. The user shall have the ability to also associate real-time electronic annotations or notes to each alarm.
 - f. Alarm messages shall be customizable for each point, or each alarm priority level, to display detailed instructions to the user regarding actions to take in the event of an alarm. Alarm messages shall also have the optional ability to individually enunciate on the workstation display via a separate pop-up window, automatically being generated as the associated alarm condition occurs.
 - g. Alarm Display application shall allow workstation operators to send and receive real-time messages to each other, for purposes of coordinating Alarm and BAS system management.
 - h. Remote notification of messages
 - 1) Workstation shall be configured to send out messages to numeric pagers, alphanumeric pagers, phones (via text to speech technology), SMS (Simple Messaging Service, text messaging) Devices, and email accounts based on a point's alarm condition.

- 2) There shall be no limit to the number of points that can be configured for remote notification of alarm conditions and no limit on the number of remote devices which can receive messages from the system.
- 3) On a per point basis, system shall be configurable to send messages to an individual or group and shall be configurable to send different messages to different remote devices based on alarm message priority level.
- 4) Remote devices may be scheduled as to when they receive messages from the system to account for operators' work schedules.
- 5) System must be configurable to send messages to an escalation list so that if the first device does not respond, the message is sent on to the next device after a configurable time has elapsed.
- 6) Message detail shall be configurable on a per user basis.
- 7) During a "flood" of alarms, remote notification messages shall have the ability to optimize several alarms into an individual remote notification message.
- 8) Workstation shall have the ability to send manual messages allowing an operator to type in a message to be sent immediately.
- 9) Workstation shall have a feature to send a heartbeat message to periodically notify users that they have communication with the system.

S. Field Devices

1. Provide instrumentation as required for monitoring, control or optimization functions.

2. Room Temperature Sensors

- a. All temperature sensors shall be BACnet compatible network type. Auditorium, Stage and Office areas shall be provided with digital combination room sensors for temperature, humidity and CO2 (two sensors may be provided in lieu of one) and shall have LCD display, day / night override button, and setpoint slide adjustment. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. All other areas/spaces including but not limited to classrooms and teaching room areas shall have combination room sensors for temperature, humidity and CO2 (two sensors may be provided in lieu of one) and shall have day / night override button, and setpoint slide adjustment options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment. Public areas such as corridors, entry areas, vestibules, restrooms shall have chrome cover plate without adjustment or override occupied/unoccupied capability. Sensors located in Gymnasiums, Alternate PE, Tech Shops, Kitchen and Locker rooms shall be provided with tamper proof guard.

Temperature monitoring range	+20/120 deg. F -13 deg. to 49 deg. C)
Output signal	Changing resistance
Accuracy at Calibration point	+0.5 deg. F (+/- 0.3 deg. C)

	Set Point and Display Range	55 deg. to 95 deg. F (13 deg. to 35 deg. C)
b.	Liquid immersion temperature:	
	Temperature monitoring range	+30/250 deg. F (-1 deg. /121 deg. C)
	Output signal	Changing resistance
	Accuracy at Calibration point	+0.5 deg. F (+/-0.3 deg. C)
c.	Duct (single point) temperature:	
	Temperature monitoring range	+20/120 deg. F (-7 deg. /49 deg. C)
	Output signal	Changing resistance
	Accuracy at Calibration point	+0.5 deg. F (+/-0.3 deg. C)
d.	Duct Average temperature:	
	Temperature monitoring range	+20 deg.+120 deg.F(-7 deg./+49 deg. C)
	Output signal	4 – 20 mA DC
	Accuracy at Calibration point	+0.5 deg. F (+03 deg. C)
	Sensor Probe Length	25 ft. L (7.3m)
e.	Outside air temperature:	
	Temperature monitoring range	-58deg.+122deg.F(-50deg.Cto 50deg.C)
	Output signal	4 – 20 mA DC
	Accuracy at Calibration point	+0.5 deg. F (+/-0.3 deg. C)
3.	Liquid Differential Pressure Transmitter	
	Ranges	0-5/30 in. H2O
		0-25/150 in. H2O
		0-125/750 in. H2O
	Output	4 – 20 mA DC
	Calibration Adjustments	Zero and span
	Accuracy	+/-0.2 percent of span
	Linearity	+/-0.1 percent of span
	Hysteresis	+/-0.05 percent of span
4.	Differential pressure:	
a.	Unit for fluid flow proof shall be Penn P74.	
	Range	8 to 70 psi
	Differential	3 psi
	Maximum differential pressure	200 psi
	Maximum pressure	325 psi

Humidistat:

Range	0 to 100 percent RH
Sensing Element	Bulk Polymer
Output Signal	4 – 20 mA DC
Accuracy	At 77 deg. F(25 deg. C) + 2 percent RH

8. Insertion Flow Meters (Equal to Onicon F-5300)

Sensing Method	Impedance Sensing
Accuracy	+ 2 percent of Actual Reading
Maximum Operating Pressure	400 PSI
Output Signal	4 – 20 mA
Bi-directional where required.	

9. Pressure to Current Transducer

Range	3 to 15 psig (21 to 103 kPa) or 3 to 30 psig (21 to 207 kPa)
Output signal	4 – 20 mA
Accuracy	+ 1 percent of full scale (+ 0.3 psig)

10. Carbon Dioxide Sensor : All room/zone CO₂ & duct mounted sensors shall be BACnet compatible network type and shall have a minimum 5 year calibration period.

Range	0 to 1500 ppm
Accuracy	20+ ppm

CO₂ sensors located in gymnasiums and locker rooms shall be provided with tamper proof guard.

11. Control Valves (all control valves shall have electric actuators with position feedback to provide confirmation of valve position).

a. Electric Control

Rangeability	40:1
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Flow Characteristics	Modified. Equal percentage
Control Action	Normal open for hot water and normal closed for cooling
Medium	Steam, water, glycol
Body Type	Screwed ends 2 in. and smaller, flanged Valves 2½ in. and larger
Body Material	Bronze
Body Trim	Bronze
Stem	Stainless Steel
Actuator	0-10 VDC, 4-20 MA or 2 position 24 VAC/120VAC – Modulating for all hot water and chilled water valves with a GPM value of 1 or above, 2 position valves for all GPM's under 1.

- b. All automatic temperature control valves in water lines shall be provided with Characterized throttling plugs and shall be sized for minimum 25 percent of the system pressure drop or three psi, whichever is less.
 - 1) Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.
 - 2) Two position valves shall be line size.

12. Damper Actuators

- a. Electric control shall be direct coupled actuators with position feedback to BMS.
- b. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.
 - 1) The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½ in. diameter shaft or damper blade.
- c. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.
- d. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.
- e. All actuators having more than a 100 lb-in torque output shall accept a 1 in. diameter shaft directly, without the need for auxiliary adapters.

- f. All actuators shall be designed and manufactured by Belimo or approved equal using ISO900 registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.
- T. Ultra-Low Leakage HVAC Control Dampers
- 1. Model: CD60 as manufactured by Ruskin Company or equal.
 - 2. Ratings:
 - a. Leakage: Damper shall have a maximum leakage of 3 cfm/sq. ft. @ 1 inch wg. and shall be AMCA licensed as Class 1A.
 - b. Size: Damper widths from 12 inches (305 mm) to 60 inches (1524 mm) meeting Class 1A as scheduled or required.
 - c. Differential Pressure: Damper shall have a maximum differential pressure rating of 13 in. w.g. (3.2 kPa) for a 12 inches (305 mm) blade.
 - d. Velocity: Damper shall have a maximum velocity rating of 6,000 fpm (1,829 m/min).
 - e. Temperature: Damper shall be rated for -72 to 275 degrees F (-58 to 135 degrees C) or as required for its intended application (ie. smoke rated, high temperature rated, fire rated, etc.)
 - 3. Construction:
 - a. Frame: 5 inches x minimum 16 gage (127 x minimum 1.6 mm) roll formed, galvanized steel hat-shaped channel, reinforced at corners. Structurally equivalent to 13 gage (2.3 mm) U-channel.
 - b. Blades:
 - 1) Style: Airfoil-shaped, single-piece.
 - 2) Action: Parallel.
 - 3) Action: Opposed.
 - 4) Orientation: Horizontal.
 - 5) Orientation: Vertical with thrust washers.
 - 6) Material: Minimum 14 gage (2.0 mm) equivalent thickness, galvanized steel.
 - 7) Width: Nominal 6 inches (152 mm).
 - c. Bearings: Self-lubricating stainless steel sleeve, turning in extruded hole in frame.
 - d. Seals:
 - 1) Blade: Extruded Ruskiprene TPV type for ultra-low leakage from -76 to 350 degrees F (-60 to 177 degrees C). Mechanically attached to blade edge.
 - 2) Jamb: Flexible metal compression type.
 - e. Linkage: Concealed in frame.
 - f. Axles: Minimum 1/2 inches (13 mm) diameter plated steel, hex-shaped, mechanically attached to blade.
 - g. Mounting: Vertical.
 - h. Mounting: Horizontal.

- i. Finish: Mill galvanized.
 - j. Finish: Stainless steel.

- U. Meters: Meters shall be provided to monitor and trend the energy consumed by the HVAC (heating, cooling, ventilation, fans) and Hot water (Heating and Domestic) serving the building. Provide the following meters (or connection to meters) and network these devices into the Building Management System.
 - 1. Provide all necessary components and accessories required for connection to main electrical KYZ pulse consumption meters (kWh). Meters shall be provided by Division 260010. Refer to Electrical Drawings for meter location.
 - 2. The energy consumption data obtained from all the meters shall be stored by the building automation system which shall export this data in real-time fashion to a software program such as "Building Dashboard" by Lucid Design Group Inc. which shall be provided by the ATC Contractor for public viewing on a digital kiosk by I&E or equal.
 - 3. The ATC Contractor shall provide and program a digital interactive kiosk which shall display building graphics, energy consumption meters, HVAC equipment, outdoor air temperature, humidity, wind speed, wind direction, and barometric pressure. Provide 60" LCD screen model podium HD manufactured by Industrial Computing Products from I&E or equal. Provide all necessary programming wiring and software for a complete and functional interactive kiosk.
 - 4. Sensors to monitor building natural gas consumption. Gas meters shall be furnished and installed by the Plumbing contractor. The ATC contractor shall provide control wiring from the meter to the BMS.
 - 5. Flow meters for cold water consumption will be installed by the Plumbing Contractor and furnished and wired to the BMS by the ATC Contractor.

- V. Miscellaneous Devices
 - 1. Thermostats (Stand-alone electric type - only where specified or indicated on drawings)
 - a. Room thermostats shall be of the gradual acting type with adjustable sensitivity.
 - b. They shall have a bi-metal sensing element capable of responding to a temperature change of one-tenth of one degree. (Provide all thermostats with limit stops to limit adjustments as required.)
 - c. Thermostats shall be arranged for either horizontal or vertical mounting.
 - d. In the vertical position thermostat shall fit on a mullion of movable partitions without overlap.
 - e. Mount the thermostat covers with tamper-proof socket head screws.

2. Freezestats:
 - a. Install freezestats on each coil that mixes outside and return air (air handling units, fan coils, unit ventilators) and provide protection for every square foot of coil surface area with one linear foot of element per square foot of coil.
 - 1) Upon detection of low temperature, the freezestats shall stop the associated supply fans and return the automatic dampers to their normal position close outside air dampers and open coil valve for full flow. Provide manual reset.
3. Firestats:
 - a. Provide manual reset, fixed temperature line voltage type with a bi-metal actuated switch.
 - 1) Switch shall have adequate rating for required load.
4. Electronic Airflow Measurement Stations and Transmitters (Where indicated on Control Drawings).
 - a. Provide air flow monitoring stations as shown on drawings.
 - b. Duct and Plenum Mounted Air Flow Measuring Stations.
 - 1) Sensor probes shall be constructed of gold anodized, 6063 aluminum alloy tube. Sensor probe mounting brackets shall be constructed of 304 stainless steel.
 - 2) Each sensor node shall be provided with two bead-in-glass, hermetically sealed thermistors potted in a marine grade waterproof epoxy with sensor housing constructed of glass-filled polypropylene.
 - 3) Sensor nodes shall operate from -20 to 160 degrees Fahrenheit. Sensor nodes shall be capable of reading velocity on a scale of 0-5,000 fpm with an accuracy of +/- 2% of actual reading.
 - 4) A remotely located microprocessor-based transmitter shall be provided for each measurement location, local readout shall be provided on unit. The transmitter shall be provided with two field selectable analog outputs (0-10 VDC or 4-20 mA) as well as an isolated RS-485 BACnet network connection.
 - 5) Provide Ebtron GTx116-P+ or Paragon FE-1000.
 - c. Fan Inlet Style Air Flow Measuring Stations
 - 1) Provide fan inlet and outdoor airflow measuring devices for air handling units as shown on drawings. Each airflow measuring device shall consist of multiple measuring probes.

- 2) Fan inlet probes shall not be mounted in the smallest diameter of the inlet of the fan, the probes shall not have a negative effect on the performance of the fan or the noise generated by the fan. In instances where access to the air handling units' fans is restricted utilize duct mounted airflow measuring probes. A remotely located microprocessor-based transmitter shall be provided for each measurement location, local readout shall be provided on unit. The transmitter shall be provided with two field selectable analog outputs (0-10 VDC or 4-20 mA) as well as an isolated RS-485 BACnet network connection.
 - 3) ATC contractor shall consult factory trained manufacturer's representative as part of this contract to assist in design and to inspect all outside air measurement installations and assist in calibrating and adjusting the air flow measuring stations as required to meet final balancing setting to provide accurate BMS monitoring and control.
 - 4) Provide Ebtron GTx108-F or Paragon Model FE-1050.
5. Current Sensing Relay:
- a. Provide solid-state, adjustable, current operated relay. Provide a relay which changes switch contact state in response to an adjustable set point value of current in the monitored A/C circuit.
 - b. Adjust the relay switch point so that the relay responds to motor operation under load as an "on" state and so that the relay responds to an unloaded running motor as an "off" state. A motor with a broken belt is considered an unloaded motor.
 - c. Provide for status device for all fans and pumps.
- W. Manufacturers: The Building Committee has elected for the automatic temperature control system to consist of the following proprietary manufacturers. The project ATC Contractor shall be a factory authorized vendor and installer of these manufacturers. The Automatic Temperature Control System shall be manufactured by:
1. Distech Controls with Tridium Niagara N4 Jace
 2. Or equal.

PART 3 - EXECUTION

3.1 ATTIC STOCK

- A. Rooftop Units
1. Four additional complete extra sets of pre and final filters for each RTU for attic stock. All these filters indicated above including the four sets of attic stock are additional to those provided for flush out and indoor air quality requirements per LEED requirements.
 2. Provide one spare set of belts for each belt-driven air handling unit.
 3. Obtain receipt from Owner that attic stock provided.

- B. Power and Gravity Ventilators
 - 1. Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.
- C. Ductwork Accessories
 - 1. Furnish extra fusible links to owner, one link for every 10 installed of each temperature range; obtain receipt.
- D. Unit Heaters
 - 1. Furnish to Owner, with receipt, (2) spare sets of filters per each unit.
- E. Condensate Discharge Pumps
 - 1. Furnish to Owner, with receipt, (10) new condensate pumps to attic stock.

3.2 CUTTING AND PATCHING

- A. Penetrations through construction as required for the Work of this Section:
 - 1. Coring: Perform all coring for required work.
 - 2. Notify Masonry Sub-Contractor of exact locations and sizes for openings required in masonry, to be executed under Section 042000 – Unit Masonry, utilizing lintels furnished per Section 055000 – Metal Fabrications.
 - 3. Cut openings in new and existing non-masonry construction where required for penetrations. All cutting shall conform to the requirements of Section 017329 – CUTTING AND PATCHING, and 024119 – DEMOLITION.
 - 4. Refer to Section 024119 – DEMOLITION for restrictions on all alterations to structural elements.
- B. Patching at penetrations through construction as required for the Work of this Section:
 - 1. Notify Masonry Sub-Contractor when plumbing work is complete at penetrations through masonry construction, and ready for patching under Section 042000 – UNIT MASONRY.
 - 2. Notify appropriate Sub-Contractors when plumbing work is complete at penetrations through non-masonry construction, and ready for patching under Sections in Division 09 - FINISHES.

3.3 INSTALLATION OF VALVES

- A. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which it was shipped.
- C. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.

- D. Examine mating flange faces for conditions which might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size and material, and for freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:
 - 1. Copper Tube 2 in. and smaller (Heating Hot Water): Solder ends.
 - 2. Steel Pipe Sizes 2 in. and smaller: Threaded or grooved-end.
 - 3. Steel Pipes Sizes 2-1/2 in. and larger: Grooved-end or welded.
- G. Valve Installation
 - 1. Locate valves for easy access and provide separate support where necessary.
 - 2. Install valves and unions for each fixture and item of equipment in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.
 - 3. Install valves in horizontal piping with the stem at or above the center of the pipe.
 - 4. Install isolation valves at all branch supply and return piping lines which serve more than two pieces of terminal heating equipment.
 - 5. Installation of Check Valves: Install for proper direction of flow as follows:
 - a. Swing Check Valves: Install in horizontal position with hinge pin level.
 - b. Wafer Check Valves: Install between 2 flanges in horizontal or vertical position.
 - c. Lift Check Valves: Install in piping line with stem upright and plumb.
- H. Threaded Connections
 - 1. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
 - 2. Align threads at point of assembly.
 - 3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
 - 4. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
- I. Flanged Connections
 - 1. Align flanges surfaces parallel.
 - 2. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.
- J. Grooved Connections
 - 1. Installation shall be in accordance with the latest published instructions from the manufacturer.

- K. Field Quality Control
 - 1. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
- L. Adjusting and Cleaning
 - 1. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive painting or insulation.

3.4 INSTALLATION OF METERS AND GAGES

- A. Installation of Temperature Gages
 - 1. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.
 - 2. Temperature Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure Cap.
- B. Installation of Pressure Gages
 - 1. General: Install pressure gages in piping tee with pressure gage located on pipe at most readable position.
 - 2. Pressure Gage Cocks: Install in piping tee with snubber. Install siphon for steam pressure gages.
 - 3. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.
- C. Installation of Flow Measuring Fittings
 - 1. General: Install flow measure fittings in piping systems located in accessible locations.
- D. Adjusting and Cleaning
 - 1. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
 - 2. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces with manufacturer's touch-up paint.

3.5 INSTALLATION OF HANGERS & ATTACHMENTS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and drawing VS101.
- B. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

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- C. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.
 - D. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purposes of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.
 - E. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.
 - F. Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 - 1. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - 2. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
 - 3. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - 4. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
 - 5. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
 - 6. Insulated Piping: Comply with the following installation requirements:
 - a. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - b. Shields: For pipe sizes up to and including 4 in. provide heavy gage shield at each hanger point.

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- c. Saddles: For all pipe sizes over 4 in. provide saddle at each hanger point. Completely fill void in saddle with loose insulation.
 - G. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
 - H. Fabricate and install anchor by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
 - I. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
 - J. Anchor Spacing: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.
 - K. Concrete housekeeping bases shall be provided by General Contractor for all floor-mounted equipment. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.
 - L. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
 - M. Adjusting and Cleaning:
 - 1. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
 - 2. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
 - 3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.6 INSTALLATION OF MECHANICAL IDENTIFICATION

- A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces; install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.
- B. General: Install pipe markers of the following type on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - 1. Plastic pipe markers, with application system as indicated. Install on pipe insulation segment where required for hot non-insulated pipes.

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- C. Locate pipe markers and color bands as follows wherever piping is in or above occupied spaces or corridors, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
1. Near each valve and control device.
 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 4. At access doors, manholes and similar access points which permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced intermediately at maximum spacing of 50 ft. along each piping run, except reduce spacing to 25 ft. in congested areas of piping and equipment.
 7. On piping above removable acoustical ceilings.
- D. Valve Identification:
1. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
 2. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.
- E. Mechanical Equipment Identification:
1. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device.
 2. Lettering Size: Minimum 1/4 in. high lettering for name of unit where viewing distance is less than 2 ft. – 0 in., 1/2 in. high for distances up to 6 ft. – 0 in. and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.
- F. Ductwork Identification:
1. Install or apply labels per manufacturer's recommendations.
 2. Install in locations where it can be viewable by personnel.
- G. Adjusting and Cleaning:
1. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
 2. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.7 INSTALLATION OF MECHANICAL INSULATION

- A. Installation of Piping Insulation:
1. Insulation

2. Composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated. Do not cover calibrated balance valves until testing adjusting and balancing has been completed. Omit insulation on hot piping within radiation enclosures which serve the zone: hot water passing through the zone must be insulated or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan. (Couplings in mechanical grooved systems will be insulated.)
3. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
4. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance tests.
5. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
6. Clean and dry pipe surfaces prior to insulating. Butt installation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
7. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
8. Cover valves, fittings and similar items in each piping system with equivalent thickness and c
9. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
10. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 in. wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 in. wide vapor barrier tape or band.

B. Installation of Ductwork Insulation:

1. General: Do not insulate ductwork until ductwork has been sealed successfully, pressure tested, and approved for application of insulation by engineer or commissioning agent. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
2. Install insulation materials with smooth and even surfaces.
3. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
4. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
5. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
6. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

C. Installation of Equipment Insulation:

1. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
2. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.
3. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
4. Do not apply insulation to equipment, breechings, or stacks while hot.
5. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.
6. Coat insulated surfaces with layers of insulating cement, troweled in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
7. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 in. Apply over vapor barrier where applicable.
8. Do not insulate boiler manholes, handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruption of insulation.
9. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

D. Protection and Replacement:

1. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
2. Protection; Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

3.8 INSTALLATION OF GREASE DUCT INSULATION

A. EXAMINATION

1. Do not begin installation until substrates have been properly prepared.
2. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
3. Coordinate installation of the Thermal Ceramics FastDoor XL access door between sheet metal and insulation trades.

B. PREPARATION

1. Remove dirt and dust from surfaces of openings and items penetrating rated floors and rated walls.

C. INSTALLATION

1. Install FireMaster FastWrap XL or Pyroscat Duct Wrap XL in direct contact with the ductwork in accordance with manufacturer's instructions, applicable laboratory listings and building code reports, and referenced standards. For additional complex duct design installation recommendations, see the Thermal Ceramics' complete installation guide.
2. Install two layers of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for zero clearance and a 1 and 2 hour commercial kitchen grease duct applications per ASTM E 2336.
 - a. General Installation Instructions for Double Layer Installations: The inside and outside layers of FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and meet with a tight butt joint. Adjacent blankets on the inside and outside layers are tightly butted against each other. Joints between blankets on the outside layer shall be offset from joints on the inside layer by a minimum 6 in. (152 mm). Cut edges of the blanket shall be taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.
3. Install 1 layer of FireMaster FastWrap XL or Pyroscat Duct Wrap XL for 1 and 2 hour air ventilation duct enclosures per ISO 6944-1985.
 - a. General Installation Instructions for Single Layer Installations: FireMaster or Pyroscat blankets are cut to a length that will fit around the duct and overlap itself no less than 3 in. (152 mm). Adjacent blankets overlap each other a minimum of 3 in. (152 mm), or they can be fitted together with a tight butt joint and covered with a 6 in. (305 mm) wide collar centered over the butt joint. Cut edges of the blanket are taped with aluminum foil tape. During installation the blankets are temporarily held in place with filament tape until the wrap is mechanically attached with steel bands or steel insulation pins.
4. Install one layer of Thermal Ceramics PlenumWrap+ on plastic pipe or plastic jacketed electrical cables per Intertek listing reports and testing to NFPA 262 and UL1887.
 - a. Cut plenum blanket to a length that will fit around the pipe or cable and overlap itself no less than 1 in. (25 mm). Adjacent blankets overlap each other a minimum of 1 in. (25 mm). Plenum blanket is secured using either 1/2 in. (12 mm) steel banding or 16 gauge carbon or stainless steel tie wire on maximum 11-1/2 in. (292 mm) spacing.
5. Mechanical Fastening of Enclosure Material to Ductwork:
 - a. Banding - Carbon steel or stainless steel banding is used to hold the outer layer of the blanket enclosure in place. Banding is minimum 1/2 in. (12.7 mm) wide, and is placed around the entire perimeter of the duct on maximum 10-1/2 in. (267 mm) centers and 1-1/2 in. (38 mm) from each blanket or collar edge.

- b. Pinning - To prevent blanket sag on duct spans wider than 24 in. (610 mm), minimum 12-gauge steel insulation pins are welded to the duct along bottom horizontal and outside vertical runs in columns spaced 12 in. (305 mm) apart, 6 to 12 in. (152 to 305 mm) from each edge, and on 10-1/2 in. (267 mm) centers. Pins are locked in place with 1-1/2 in. (38 mm) diameter or 1-1/2 in. (38 mm) square galvanized steel speed clips or cup head pins. Pins are turned down or the excess cut off to eliminate sharp edges.
6. Grease Duct Access Door Installation:
 - a. Install Thermal Ceramics FastDoor XL per manufacturers' instructions, and applicable building code reports and laboratory design listings.
7. Through-Penetration Firestop System:
 - a. When the duct penetrates a concrete or dry wall fire rated floor, ceiling, or wall an approved firestop system shall be employed. FireMaster or Pyroscat insulation shall be installed directly to the duct through the penetration, or terminated on both sides of the penetration depending on the annular space allowance between the duct and the duct opening. When the FireMaster or Pyroscat enclosure system is terminated on both sides of the through penetration, the duct wrap material is mechanically attached to the duct at the termination points using either steel banding or steel pins.
 - b. To fire stop the through penetration void area, fill the annular space between the wrapped duct or bare duct and the periphery of the opening with scrap FireMaster or Pyroscat insulation firmly packed into the opening. Compress scrap blanket to percentage stated in the firestop listing for a minimum depth as specified in the firestop listing. Recess packing material below surface on both sides of walls or top side only for floors to the depth stated in the firestop listing. Seal over the packing material using an approved firestop sealant to a depth as stated in the firestop listing, flush with top side of a floor assembly and both sides of a wall assembly.

D. REPAIR PROCEDURES

1. Repair damaged FireMaster FastWrap XL or Pyroscat Duct Wrap XL in accordance with manufacturer's instructions.
2. Remove damaged section by cutting the bands and removing the anchor clips holding it in place. Apply a new section of the same dimension ensuring the same overlap and installation method that existed previously. Cut edges and tears in the foil must be taped with aluminum tape to prevent the insulation from wicking moisture or grease.

E. PROTECTION

1. Protect installed products until completion of project.
2. Touch-up, repair or replace damaged products before Substantial Completion.

3.9 INSTALLATION OF HYDRONIC PIPING AND ACCESSORIES

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. Piping Installations:
1. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design consideration. So far as practical, install piping as indicated.
 2. Install piping at a uniform grade of 1 in. in 40 ft. upward in the direction of flow.
 3. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
 4. Install branch connections to mains using Tee fittings in main with take-off out the bottom, except for up-freed risers which shall have take-off out the top of the main line.
 5. Install unions in pipes 2 in. and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 6. Install flanges on valves, apparatus, and equipment having 2-1/2 in. and larger connections.
 7. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, inline pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2 in. and larger.
 8. Anchor piping to ensure proper direction of expansion and contraction. Expansion loops and joints are indicated on the Drawings.
 9. Install pipe sleeves at all wall and floor penetrations.
 10. Install escutcheons at all exposed pipe wall penetrations.
 11. Provide Dielectric couplings at all dissimilar piping/valve connections.
- C. Pipe Applications:
1. Copper Tubing: Use Type L, drawn copper tubing with wrought copper fittings and solder joints for 2 in. and smaller, above ground, within building. Use Type K, annealed temper copper tubing for 2 in. and smaller without joints, below ground or within slabs. Mechanical fittings (crimp or flair) are not permitted.
 2. Steel Pipe: Use steel pipe with threaded joints and fittings for 2 in. and smaller, and with welded joints for 2-1/2 in. and larger.
 3. Steel Pipe: Use mechanical grooved end steel pipe and mechanical couplings and fittings.
- D. Grooved Pipe Ends and Fittings:
1. Roll Groove pipe ends in accordance with the latest published instructions from manufacturer of grooved couplings.

2. Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. All grooved system components shall be of same manufacturer. Use grooved-end fittings and rigid or flexible, where required, grooved-end-pipe couplings. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
3. Training
 - a. The grooved coupling manufacturer's (the "manufacturer") factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of groove joints products.
 - b. IACET/Training: A factory trained manufacturer's representative (direct employee) shall provide on-site training of contractor's field personnel in the use of grooving tools, application of groove, and product installation in compliance with the following:
 - 1) Manufacture must be accredited by the International Association for Continuing Education and Training (IACET).
 - 2) IACET Accredited Provider status demonstrates that the manufacture complies with the ANSI/IACET standard, which is recognized internationally as a standard of excellence in instructional practices.
4. Inspection
 - a. A manufacture's factory trained representative shall periodically visit the job site and review the installation for best practices. The installing Contractor shall correct any identified deficiencies.
 - b. The grooved fittings manufacturer's product that has been examined and has not met the visual inspection criteria for proper installation must be corrected and re-examined by Inspection Services prior to the completion of the project. Any Victaulic product that has not been corrected or was not examined will not be considered as part of the successful completion of Inspection Services.
5. Application
 - a. Upon completion of the manufacturer's inspection of the installation and any identified corrections, the manufacturer may provide the Owner or purchaser with a limited warranty on manufacturer's products.

E. Valve Applications:

1. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
 - a. Shut-Off Duty: Use gate, and ball, valves.
 - b. Throttling Duty: Use globe, ball, and plug valves.
2. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.

3. Install pump discharge valves with stem in upward position; allow clearance above stem for check mechanism removal.
 4. Install safety relief valve on hot water generators, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for installation requirements.
 5. Install pressure reducing valves on hot water generators, and elsewhere as required to regulate system pressure.
 6. Install isolation valves in all branch supply take-offs from piping mains which serve more than two terminal heating or cooling units. Provide balancing valve with positive shut off in all return branch take-offs which serve more than two terminal heating or cooling units. Provide isolation valves in floor supply main piping lines and balancing valves with positive shut-off in all floor return main piping take-offs.
- F. Hydronic Specialties Installation:
1. Install automatic air vents at high points in the system, heat transfer coils, and elsewhere as required for system air venting. Install air vents with cocks such that vents can be removed without draining system.
 2. Install combination separator/strainer in pump suction lines. Run piping to compression tank with 1/4 in. per foot (two percent) upward slope towards tank. Install blowdown piping with gate valve; extend to nearest drain.
 3. Install pump suction diffusers on pump suction inlet, adjust foot support to carry weight of suction piping. Install nipple and ball valve in blowdown connection.
 4. Install shot-type chemical feeders in each hydronic system; in upright position with top of funnel not more than 48 in. above floor. Install feeder in bypass line, off main using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.
 5. Install diaphragm-type compression tanks as indicated. Vent and purge air from hydronic system, charge tank with proper air charge to suit system design requirements.
 - a. In the absence of details provide support from the floor or structure above sufficient for the weight of water assuming a full tank of water. Do not overload building components and structural members.
- G. Field Quality Control:
1. Preparation for Testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
 - a. Leave joints including welds uninsulated and exposed for examination during the test.
 - b. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - c. Flush system with clean water. Clean strainers.

- d. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - e. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
2. Testing: Test hydronic piping as follows:
- a. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
 - b. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at point for complete removal of the liquid.
 - c. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
 - d. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, Building Services Piping.
 - e. After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connection for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.
- H. Adjusting and Cleaning:
- 1. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
 - 2. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.
- 3.10 INSTALLATION OF REFRIGERANT PIPING AND ACCESSORIES
- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.

B. Piping Installations:

1. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, and other design consideration. So far as practical, install piping as indicated.
2. Install pipe sleeves at all wall and floor penetrations.
3. Install escutcheons at all exposed pipe wall penetrations.

3.11 INSTALLATION OF CONDENSING BOILERS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. General: Install boilers in accordance with manufacturer's installation instructions, in accordance with State and Local Code requirements. Install units plumb and level, to tolerance of 1/8 in. in 10 ft. – 0 in. in both directions. Maintain manufacturer's recommended clearances around and over boilers.
- C. Support: Install boilers on 4 in. thick concrete pad, 4 in. larger on each side than base of unit. Provide supplemental structural steel supports (minimum 8 in. high) to elevate boiler as required to allow proper condensate drainage.
- D. Electrical Work: Install electrical devices furnished by manufacturer but not specified to be factory mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
1. Verify that electrical work installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment Installer.
- E. Gas Piping: Connect gas piping to boiler, full size of boiler gas train inlet, provide union with sufficient clearance for burner removal and service.
- F. Hot Water Piping: Connect supply and return boiler tappings as indicated, with shutoff valve and union or flange at each connection.
- G. Regulator Vents: Provide 3/4 in. vent from each main and pilot regulator. Each vent shall terminate outdoors per code requirements.
- H. Breeching: Connect breeching to boiler outlet, full size of outlet. Route as indicated. Coordinate breeching routing and sizing with Boiler Manufacturer and vent system manufacturer.
- I. Flush and clean boilers upon completion of installation, in accordance with manufacturer's start-up instructions.
- J. Hydrostatically test assembled boiler and piping in accordance with applicable sections of ASME Boiler and Pressure Vessel Code.

- K. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boiler piping, observation of hydrostatic testing, and for certification of completed boiler units.
- L. Start-up boilers, in accordance with manufacturer's start-up instructions, and in presence of boiler manufacturer's start up representative. Test controls, and demonstrate compliance with requirements. Adjust burner for maximum burning efficiency. Replace damaged or malfunctioning controls and equipment.
- M. Owner's Instructions: Provide services of manufacturer's technical representative for 4-hour day to instruct Owner's personnel in operation and maintenance of boilers.
 - 1. Schedule training with Owner, provide at least 7-day notice to Contractor and Engineer of training date.
- N. Boiler Installation
 - 1. Install boilers level on concrete base.
 - 2. Install gas-fired boilers according to NFPA 54.
 - 3. Install boiler hot water and condensate drain piping.
 - 4. Assemble and install boiler trim.
 - 5. Install electrical devices furnished with boiler but not specified to be factory mounted.
 - 6. Install control wiring to field-mounted electrical devices.
- O. Connections
 - 1. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
 - 2. All external hydraulic connections shall be able to be connected in any configuration on either the left or right side of the Boiler(s) in order to allow for maximum installation flexibility and site requirements.
 - 3. Install piping adjacent to boiler to allow service and maintenance.
 - 4. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
 - 5. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
 - 6. Connect hot-water piping to supply- and return-boiler connections with shutoff valve and union or flange at each connection.
 - 7. Install piping from safety relief valves to nearest floor drain.
 - 8. Boiler Venting:
 - a. Install flue venting per manufacturer's requirements and Plumbing Division 22 requirements.
 - b. Connect full size to boiler connections. Comply with requirements in Division 22 Section "Breechings, Chimneys, and Stacks."
 - 9. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
 - 10. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

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- P. Field Quality Control
1. Perform tests and inspections and prepare test reports.
 - a. Manufacturer's Field Service: Engage a factory-authorized service representative or technician to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 2. Tests and Inspections:
 - a. Perform installation and startup checks according to manufacturer's written instructions.
 - b. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
 - c. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
 - d. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 1) Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - 2) Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 3. Remove and replace malfunctioning units and retest as specified above.

- Q. Demonstration
1. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

3.12 INSTALLATION OF AIR INTAKE AND EXHAUST BREECHING, CHIMNEYS AND STACKS

- A. VIBRATION CONTROL AND SEISMIC RESTRAINT: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
- B. Install all gas vents/intakes in accordance with manufacturer's installation instructions and UL listing. Maintain minimum clearances from combustibles specified in UL listing.
- C. Seal joints between sections of positive pressure vents in accordance with manufacturer's installation instructions, and using only sealants recommended by manufacturer.
- D. Support vents at intervals recommended by the manufacturer to support the weight of the vent and all accessories, without exceeding loading of appliances.
- E. Install barometric and thermostatically operated dampers in accordance with manufacturer's instructions. Locate as close to draft hood collar as possible.
- F. Clean breechings internally during installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth.

- G. Temporary Closure: At ends of breechings and chimneys which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until installations are completed.

3.13 INSTALLATION OF CONDENSATE NEUTRALIZING TUBES

- A. Refer to the Manufacturer's recommendations for the installation of Condensate Neutralizing Tubes.

3.14 INSTALLATION OF HVAC PUMPS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. General: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized practices to ensure that HVAC pumps comply with requirements and serve intended purposes.
- C. Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer.
- D. Support: Install base-mounted pump assembly on minimum of four in. high concrete base equal or greater than three times total weight of pump and motor. Set and level pump in base and grout with non-shrink grout.
- E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- F. Adjusting and Cleaning
 - 1. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.
 - 2. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
 - 3. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.15 INSTALLATION OF AIR COOLED CHILLER

- A. Vibration Control, refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230923 and drawing VS101.

B. GENERAL:

1. Verify all dimensions by field measurements. Verify structure, mounting supports, and membrane installations are completed to the proper point to allow installation of units. Examine rough-in for piping systems to verify actual locations of piping connections prior to installation. Do not proceed until unsatisfactory conditions have been corrected.
2. Install chiller in accordance with manufacturers installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

C. FIELD QUALITY CONTROL:

1. Provide the services, to include a written report, of a factory authorized service representative to examine the field assembly of the components, installation, and piping and electrical connections. Submit start-up report to engineer for review.

D. DEMONSTRATION:

1. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below.
2. Start-up service: Place units into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.

E. TRAINING:

1. Train the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures. Provide a minimum of 8 hours of training.
2. Schedule training with Owner through the Architect/Engineer with at least 7 days prior notice. Video record training session. Submit media to Owner upon completion of training.

3.16 INSTALLATION OF HVAC ROOFTOP UNITS (RTU)

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.
- C. Support: Contractor shall coordinate installation with the roofing contractor, and shall install and secure roof curb to roof structure, per details on the drawings and in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.

- D. Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.
- E. Duct Connections: Provide ductwork, accessories, and flexible connections as indicated.
- F. Piping Connection: Provide insulated piping connection for hot and chilled water. Provide condensate drain p-traps and pipe condensate to nearest roof drain. Size condensate p-trap and piping per rooftop manufacturers requirements.
- G. Grounding: Provide positive equipment ground for air-handling unit components.
- H. Provide a complete set of filters, (pre-final-erw) for each roof top unit and install at the completion of air handling system work and prior to unit operation. Provide another complete set of filters prior to the LEED flushout requirements. After the projects substantial completion and flush out requirements are complete, site work will begin and create an increased amount of dust. During this time frame of one year, provide the owner with four complete sets of filters for each rooftop unit as attic stock, these filters will be installed by the owner. Provide receipt from Owner that new filters have been installed and additional extra attic stock filters have been provided.
- I. Provide one spare set of belts for each belt-driven air handling unit, obtain receipt from Owner that belts have been received.
- J. Electrical Connections: Refer to electrical sections for final connections to equipment and installation of loose shipped electrical components.
- K. Start-Up Services:
 - 1. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
- L. Operating and Maintenance Training:
 - 1. Provide services of manufacturer's service representative (minimum 8 hrs.) to instruct Owner's personnel in operation and maintenance of rooftop units. Training shall include start-up and shut-down, servicing and preventative maintenance schedule and procedures, and trouble-shooting procedures plus procedures for obtaining repair parts and technical assistance.
 - 2. Schedule training with Owner, provide at least 7-day prior notice to the Architect/Engineer.

3.17 INSTALLATION OF TERMINAL HEATING UNITS (HYDRONIC)

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.

- B. Installation of Finned Tube Radiation: (Hydronic)
 - 1. General: Install finned tube radiation as indicated, and in accordance with manufacturer's installation instructions.
 - 2. Locate finned tube radiation as indicated, run cover wall-to-wall unless otherwise indicated. Provide butt caps, splice joints, and "Z" bends for a complete installation.
 - 3. Install access panels centered in front of each shutoff valve, balancing cock, steam trap, or temperature control valve.

- C. Installation of Convectors: (Hydronic)
 - 1. General: Install convectors as indicated, and in accordance with manufacturer's installation instructions.
 - 2. Locate convectors as indicated, coordinate with other trades to assure correct recess size for recessed convectors.

- D. Installation of Horizontal Unit Heaters: (Hydronic)
 - 1. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.
 - 2. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.
 - 3. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.
 - 4. Support units with rod-type hangers anchored to building substrate.
 - 5. Install piping as indicated.
 - 6. Protect units with protective covers during balance of construction.

- E. Installation of Cabinet Unit Heaters: (Hydronic)
 - 1. General: Install cabinet heaters as indicated, and in accordance with manufacturer's installation instructions.
 - 2. Coordinate with other trades to assure correct recess size for recessed units.
 - 3. Install piping as indicated.
 - 4. Protect units with protective covers during balance of construction.

- F. Installation of Coils: (Hydronic)
 - 1. General: Install coils as indicated, and in accordance with manufacturer's installation instructions.
 - 2. Pitch coil casings for drainage, not less than 1/8 in. toward return connections, except where drainage feature is included in coil design.

- G. Installation of Radiant Panels
 - 1. Install radiant panel level and plumb. Maintain sufficient clearance for normal services, maintenance, or in accordance with construction drawings.
 - 2. Complete installation and startup checks according to manufacturer's written instructions and perform the following:
 - a. Verify that controls and control enclosure are accessible.

- b. Verify that control connections are complete to control valves as needed.
 - c. Verify that any identification tags are visible.
 - d. Verify that controls respond to inputs as specified.
3. Connections
- a. Piping installation requirements are specified in other Division 23 Sections. Drawings indicated general arrangement of piping, fittings, and specialties.
 - b. Install piping adjacent to radiant panels to allow for service and maintenance.
 - c. In addition to Division 23 Section "Hydronic Piping", connect copper tubing to supply with shut-off valve, strainer, control valve, and union or flange, and return pipe with balancing valve and union or flange.
 - d. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
 - e. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening.
4. Field Quality Control
- a. Perform the following field tests and inspections and prepare test reports:
 - 1) Leak Test: After installation, fill water tubes and test for leaks. Repair leaks and retest until no leaks exist.
 - 2) Operational Test: After electrical circuitry has been energized, start units to conform to proper unit operation.
 - 3) Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - b. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field assembled components and equipment installation, including connections, and to assist in field testing. Report any findings in writing.
 - c. Remove and replace malfunctioning units and retest as specified above.
5. Cleaning and Protection
- a. Clean all visible surfaces of equipment; touch up as required.
 - b. Protect all units before, during and after installation. Damaged materials due to improper protection shall be cause for rejection.
6. Construction Phase Services
- a. Manufacturer or factory-authorized representative shall visit the site regularly during the installation process to ensure proper means and methods are being employed. Bid shall include the cost of a minimum of two (2) such visits.
 - b. Manufacturer or factory-authorized representative shall provide start-up and training services to owners/staff to adjust, operate, and maintain radiant panels.

- H. Adjusting and Cleaning:
 - 1. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
 - 2. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
 - 3. Install new filter units for terminals requiring same.
 - 4. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- I. Provide spare filters for each cabinet unit heater. Provide enough filters to do 3 complete filter change outs at each cabinet unit heater. Obtain receipt from Owner that stock of spare filters has been received.

3.18 INSTALLATION OF TERMINAL HEATING UNITS (ELECTRIC)

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. Installation of Electric Heating Terminals:
 - 1. Install electric heating terminal units including components as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices; complying with applicable installation requirements of NEC and NECA's "Standard of Installation".
 - 2. Coordinate with other electrical work, including wiring/cabing, as necessary to properly interface installation of heating terminal units with other work.
 - 3. Clean dust and debris from each heating terminal as it is installed to ensure cleanliness.
 - 4. Comb out damaged fins where bent or crushed before covering elements with enclosures.
 - 5. Touch-up scratched or marred heating terminal enclosure surfaces to match original finishes.
 - 6. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminal to comply with tightening torques specified in UL Std. 486A.

- C. Grounding:
 - 1. Provide equipment grounding connections for electric heating terminals as indicated, Tighten connections to comply with tightening torque values specified in UL std. 486A to assure permanent and effective grounding.

- D. Electrical Wiring:
 - 1. General: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electric Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
 - b. Upon completion of installation of electric heating terminals, and after building circuitry has been energized, test heating terminals to demonstrate capability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
 - c. Replace electric heating terminals and accessories which are damaged and remove damaged items from construction site.

- E. Adjusting and Cleaning:
 - 1. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
 - 2. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
 - 3. Install new filter units for terminals requiring same.

3.19 INSTALLATION OF POWER AND GRAVITY VENTILATORS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that products serve the intended function.
- C. Coordinate ventilator work with work of roofing, walls and ceilings, as necessary for proper interfacing.
- D. Ductwork: Connect ducts to ventilators in accordance with manufacturer's installation instruction, and details on drawings.
- E. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

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- F. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - 1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
 - G. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.
 - H. Testing: After installation of ventilators has been completed, test each ventilator to possible, field correct malfunctioning units, then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
 - I. Cleaning: Clean factory-finished surface. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
 - J. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

3.20 INSTALLATION OF METAL DUCTWORK

- A. Installation of Metal Ductwork:
 - 1. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (five percent leakage for systems rated 3 in. and under; one percent for systems rated over 3 in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately with internal surface smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
 - 2. Sealing: All ductwork joints and seams shall be sealed with flexible duct sealer to assure an airtight installation.
 - 3. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2 in. Fasten to duct and substrate.
 - a. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
 - 4. Coordination: Coordinate duct installation with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
 - 5. Installation: Install metal ductwork in accordance with "SMACNA HVAC Duct Construction Standards".
- B. Installation of Duct Liners:
 - 1. General Install duct liners in accordance with SMACNA "HVAC Duct Construction Standards".

- C. Installation of Flexible Ducts:
 - 1. Maximum Length: For any duct run using flexible ductwork, do not exceed 4 ft.-0 in. extended length.
 - 2. Installation: Install in accordance with Section II of SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible".
- D. Field Quality Control:
 - 1. Leakage Tests: After each duct system that is constructed test for duct leakage in accordance with SMACNA "HVAC Air Duct Leakage Test Manual". Repair leaks and repeat tests until SMACNA requirements are achieved.
 - 2. Ductwork associated with smoke exhaust fans shall be pressure tested to 1.5 times the maximum design pressure.
- E. Equipment Connections:
 - 1. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery.
- F. Adjusting and Cleaning:
 - 1. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
 - 2. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until final connections are to be completed.
 - 3. Balancing: Refer to Division 23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork. Seal any leaks in ductwork that become apparent in balancing process.
- G. Construction IAQ Management:
 - 1. Follow the SMACNA guidelines for "Duct Cleanliness for New Construction Guidelines" according to advanced levels of cleanliness. Including but not limited to:
 - a. Specify that ductwork be sealed when transported to the construction site
 - b. Store ductwork in clean, dry conditions and keep sealed while it is stored.
 - c. Wipe down internal surfaces of ductwork immediately prior to installation to remove dust.
 - d. Seal open ends on completed ductwork and overnight work-in-progress.
 - e. During installation, protect ductwork waiting to be installed with surface wrapping.
 - f. During construction, seal HVAC supply and return openings to protect them from dust infiltration.
- H. Installation Of Exterior Preinsulated Ductwork
 - 1. Installation of Ductwork

- a. Installation of the pre-insulated ducting system to be in accordance with manufacturer Installation Guide Lines.
2. Air Leakage
 - a. Ductwork system air leakage shall be in accordance with the requirements of the relevant jurisdiction. (Consult the DOE (US Department of Energy) ComCheck / ResCheck or the relevant authority for applicable codes / standards).
3. Support
 - a. It shall be the responsibility of the installer to ensure that the ductwork system is properly and adequately supported. It shall be the responsibility of the installer to ensure that the chosen method of support is compatible with ductwork fabricated from the pre-insulated duct manufacturer.
 - b. Supports on straight runs of the pre-insulated ductwork System shall be positioned at center's not exceeding 10 ft for ductwork sections fabricated in 10 ft lengths, and 13 ft for ductwork sections fabricated in 13 ft lengths.
 - c. Additionally, ductwork shall be supported at changes of direction, at branch duct connections, tee fittings and etc.
 - d. All ductwork accessories such as dampers shall be independently supported.
4. Hangers and Supports
 - a. Hanger Materials: SMACNA Approved duct supports shall be utilized in accordance with SMACNA Standards for Phenolic Duct.
 - b. Penetration into the QDuct system duct is not permitted.
 - c. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
5. Exterior Duct Supports:
 - a. To meet all SMACNA and ASHRAE requirements.
 - b. Supports to be installed on the outside finished pre-insulated duct system
6. Storage and Handling
 - a. Care shall be exercised in the handling and transportation of pre-insulated sections in order to prevent physical damage.
 - b. All ductwork sections shall be stored under cover, clear of the ground or roof and protected from the weather and sunlight by an opaque and light colored waterproof material. In cases where the ductwork sections are to be stored for prolonged periods, the open ends of the ductwork sections shall be sealed with a polythene sheet or other suitable material to prevent the ingress of foreign matter.

3.21 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

- B. Install turning vanes in square or rectangular 90 degree elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- C. Install volume and/or splitter damper with adjusting rod in each supply branch. Install according to detail on drawings.
- D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- E. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.
- F. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
- G. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
- H. Furnish extra fusible links to owner, one link for every 10 installed of each temperature range; obtain receipt.

3.22 INSTALLATION OF FABRIC DUCT

- A. INSTALLATION OF TEXTILE AIR DISPERSION SYSTEM:
 - 1. Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.
- B. CLEANING AND PROTECTION:
 - 1. Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
 - 2. Temporary Closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
 - 3. If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

3.23 INSTALLATION OF ACOUSTIC DUCT LINING

- A. Installation: All portions of duct designed to receive duct liner shall be completely covered. The smooth, black coated surfaces shall face the airstream. All liners shall be cut to assure tight, overlapped corner joints. The top pieces shall be supported by the side pieces. The liner shall be adhered to the sheet metal with full coverage of an approved adhesive that conforms to ASTM C 916, and all exposed leading edges and transverse joints shall be coated with Permacote factory-applied or field-applied edge coating and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with "Schuller SuperSeal Edge Treatment" or approved adhesive. The liner shall be additionally secured with mechanical fasteners. The pin length should be such as to hold the material firmly in place with minimum compression of the material.

3.24 INSTALLATION OF SOUND ATTENUATORS

- A. Vibration Control and Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
- B. General: Install sound attenuators as indicated, and in accordance with manufacturer's installation instructions.
- C. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.
- D. Upon completion of installation test and demonstrate that sound attenuators, and duct connections to sound attenuators, are leak tight.

3.25 INSTALLATION OF AIR OUTLETS AND INLETS

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.
 - 1. INSTALLATION OF INDUCTION TERMINAL UNIT (ACTIVE CHILLED BEAMS)
 - a. Vibration Control and Seismic Restraint: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
 - b. General: Install induction terminal unit as indicated, and in accordance with manufacturer's installation instructions.

- c. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.

3.26 INSTALLATION OF VARIABLE AIR VOLUME BOX (VAV)

- A. VIBRATION CONTROL AND SEISMIC RESTRAINT: Refer to section 23 05 48 and drawing VS-1 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in section 23 05 48 and drawing VS-1.
- B. General: Install variable air volume boxes as indicated, and in accordance with manufacturer's installation instructions.
- C. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.
- D. Install all transformers within junction boxes and maintain three foot clearance in front per the electrical code. This will allow the VAV control box to only utilize low voltage wiring and not be susceptible to the three foot clearance requirement by the electrical code.

3.27 INSTALLATION OF CONSTANT VOLUME DAMPERS

- A. General: Install variable air volume boxes as shown on drawings, and in accordance with manufacturer's installation instructions. Utilize recognized industry practices to ensure that products serve intended function.
- B. Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for future adjustments, but in no case less than that recommended by manufacturer.

3.28 INSTALLATION OF DUCTLESS COOLING UNIT SYSTEMS

- A. Vibration Control And Seismic Restraint: Refer to SECTION 230548 and Drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control and seismic restraint manufacturer shall recommend the correct connection and device as outlined in SECTION 230548 and Drawing VS101.
- B. General:
 - 1. Verify all dimensions by field measurements. Verify roof structure, mounting supports, wall structure, and membrane installations are completed to the proper point to allow installation of wall mounted and roof mounted units. Examine rough-in for refrigerant piping systems to verify actual locations of piping connections prior to installation. Do not proceed until unsatisfactory conditions have been corrected.
 - 2. Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

- C. Field Quality Control:
 - 1. Provide the services, to include a written report, of a factory authorized service representative to examine the field assembly of the components, installation, and piping and electrical connections.
 - 2. Charge systems with refrigerant and oil, and test for leaks. Repair leaks and replace lost refrigerant and oil.
- D. Demonstration:
 - 1. Provide the services of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below.
 - 2. Start-up service: Place units into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.
- E. Training:
 - 1. Provide the services of manufacturer's service representative (two hours minimum) to instruct the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, controller features, and servicing and preventative maintenance schedules and procedures.
 - 2. Schedule training with Owner through the Architect/Engineer with at least seven days prior notice.

3.29 INSTALLATION OF CONDENSATE DISCHARGE PUMPS

- A. Examine areas and conditions under which pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.
- B. Installation Of Equipment
 - 1. General: Install equipment in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in drain pans and locations indicated, and maintain manufacturer's recommended clearances.
 - 2. Accessories: Install equipment accessories not installed at factory.
 - 3. Connections: Connect discharge piping as indicated and terminate where indicated on the contract documents.
 - 4. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
- C. Field Quality Control
 - 1. General: Start-up equipment, in accordance with manufacturer's start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Closeout Procedures

1. Training: Instruct Owner's personnel in operation and maintenance of condensate discharge pumps.

3.30 INSTALLATION OF FIRESTOP SYSTEMS

- A. General: Install firestop systems at all fire-rated and smoke rated construction where penetrated by the Work of this Section.
- B. Refer to Section 078400 - FIRESTOPPING, for all installation requirements for maintaining integrity of fire-rated and smoke rated construction at penetrations.

3.31 INSTALLATION OF WALL AND CEILING ACCESS DOORS

- A. General: Install access doors in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. All access doors shall be located in a workmanlike manner in closets, storage rooms, and/or other non-public areas, positioned so that the item or part can be easily reached, and the size shall be sufficient for this purpose (minimum size 12 in. X 16in.). Furnish access doors to permit thorough inspection. When access doors are required in corridors, lobbies, or other habitable areas, they shall be located as directed by the Architect.

3.32 INSTALLATION OF WATER TREATMENT

A. INSPECTION

1. General: Examine areas and conditions under which treatment systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer. Refer to water treatment section for requirements and further information.

B. INSTALLATION OF WATER TREATMENT SYSTEM

1. General: Install water treatment system in accordance with manufacturer's written instructions.
2. Coordinate with other work as necessary to interface components of water treatment system properly with condenser cooling water.
3. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
4. Install pressure gages, valves, and controls furnished by manufacturer, in accordance with manufacturer's instructions.

C. START-UP

1. Start-up Procedures: During heating and cooling water system start-up, operate heating and cooling water treatment system after charging with specified chemicals to maintain required steady-state characteristics of heating and cooling water.

3.33 INSTALLATION OF ROOFTOP MECHANICAL ENCLOSURE

- A. Vibration Control: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
- B. General: Install in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in location indicated, and maintain manufacturer's recommended clearances.
- C. Support: Contractor shall coordinate installation with the roofing contractor, and shall install and secure roof curb to roof structure, per details on the drawings and in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.
- D. Access: Provide access space around equipment for service, but in no case less than that recommended by manufacturer.

E. INSTALLATION OF VALVES

1. Examine valve interior through the end ports, for cleanliness, freedom from foreign matter and corrosion. Remove special packing materials, such as blocks used which prevents disc movement during shipping and handling.
2. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the position in which it was shipped.
3. Examine threads on both the valve and the mating pipe for form (out-of-round or local indentation) and cleanliness.
4. Examine mating flange faces for conditions which might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size and material, and for freedom from defects and damage.
5. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select valves with the following ends or types of pipe/tube connections:
 - a. Copper Tube 2 in. and smaller (Heating Hot Water): Solder ends.
 - b. Steel Pipe Sizes 2 in. and smaller: Threaded or grooved-end.
 - c. Steel Pipes Sizes 2-1/2 in. and larger: Grooved-end or welded.
6. Valve Installation
 - a. Locate valves for easy access and provide separate support where necessary.

- b. Install valves and unions for each item of equipment or accessory in a manner to allow equipment removal without system shut-down. Unions are not required on flanged devices.
 - c. Install valves in horizontal piping with the stem at or above the center of the pipe.
 - d. Install isolation valves at all branch supply and return piping lines which serve more than two pieces of terminal heating equipment.
 - e. Installation of Check Valves: Install for proper direction of flow as follows:
 - 1) Swing Check Valves: Install in horizontal position with hinge pin level.
 - 2) Wafer Check Valves: Install between 2 flanges in horizontal or vertical position.
 - 3) Lift Check Valves: Install in piping line with stem upright and plumb.
7. Threaded Connections
- a. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.
 - b. Align threads at point of assembly.
 - c. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
 - d. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
8. Flanged Connections
- a. Align flanges surfaces parallel.
 - b. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using a torque wrench.
9. Grooved Connections
- a. Installation shall be in accordance with the latest published instructions from the manufacturer.
10. Field Quality Control
- a. Testing: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks; replace valve if leak persists.
11. Adjusting and Cleaning
- a. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare to receive painting or insulation.

F. INSTALLATION OF METERS AND GAGES

- 1. Installation of Temperature Gages
 - a. General: Install temperature gages in vertical upright position, and tilted so as to be easily read by observer standing on floor.

- b. Temperature Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure Cap.
 2. Installation of Pressure Gages
 - a. General: Install pressure gages in piping tee with pressure gage located on pipe at most readable position.
 - b. Pressure Gage Cocks: Install in piping tee with snubber. Install siphon for steam pressure gages.
 - c. Pressure Gage Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.
 3. Installation of Flow Measuring Fittings
 - a. General: Install flow measure fittings in piping systems located in accessible locations.
 4. Adjusting and Cleaning
 - a. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.
 - b. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked or broken windows; repair any scratched or marred surfaces with manufacturer's touch-up paint.

G. INSTALLATION OF HANGERS AND ATTACHMENTS

1. Vibration Control: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
2. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
3. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.
4. Install building attachments at required locations within enclosure's structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

5. Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
 - a. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.
 - b. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by other recognized industry methods.
 - c. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
 - d. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
 - e. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
 - f. Insulated Piping: Comply with the following installation requirements:
 - 1) Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
 - 2) Shields: For pipe sizes up to and including 4 in. provide heavy gage shield at each hanger point.
 - 3) Saddles: For all pipe sizes over 4 in. provide saddle at each hanger point. Completely fill void in saddle with loose insulation.
6. Provide equipment support bases for all floor-mounted equipment. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation.
7. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.
8. Adjusting and Cleaning:
 - a. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
 - b. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
 - c. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

H. INSTALLATION OF HYDRONIC PIPING AND ACCESSORIES

1. Vibration Control: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
2. Piping Installations:
 - a. Locations and Arrangements: Drawings indicate the general location and arrangement of piping systems. Locations and arrangements of piping take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design consideration. So far as practical, install piping as indicated.
 - b. Install piping at a uniform grade of 1 in. in 40 ft. upward in the direction of flow.
 - c. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up.
 - d. Install branch connections to mains using Tee fittings in main with take-off out the bottom, except for up-freed risers which shall have take-off out the top of the main line.
 - e. Install unions in pipes 2 in. and smaller, adjacent to each valve, at final connections of each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
 - f. Install flanges on valves, apparatus, and equipment having 2-1/2 in. and larger connections.
 - g. Install strainers on the supply side of each pressure reducing valve, pressure regulating valve, pump, and elsewhere as indicated. Install nipple and ball valve in blow down connection of strainers 2 in. and larger.
 - h. Install pipe sleeves at all wall and floor penetrations.
 - i. Install escutcheons at all exposed pipe wall penetrations.
 - j. Provide Dielectric couplings at all dissimilar piping/valve connections.
3. Pipe Applications:
 - a. Copper Tubing: Use Type L, drawn copper tubing with wrought copper fittings and solder joints for 2 in. and smaller, above ground, within building. Use Type K, annealed temper copper tubing for 2 in. and smaller without joints, below ground or within slabs. Mechanical fittings (crimp or flair) are not permitted.
 - b. Steel Pipe: Use steel pipe with threaded joints and fittings for 2 in. and smaller, and with welded joints for 2-1/2 in. and larger.
 - c. Steel Pipe: Use mechanical grooved end steel pipe and mechanical couplings and fittings.
4. Grooved Pipe Ends and Fittings:
 - a. Roll Groove pipe ends in accordance with the latest published instructions from manufacturer of grooved couplings.

- b. Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. All grooved system components shall be of same manufacturer. Use grooved-end fittings and rigid or flexible, where required, grooved-end-pipe couplings. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
 - c. Inspection
 - 1) A manufacturer's factory trained representative shall visit the job site and review the installation. The installing Contractor shall correct any identified deficiencies.
 - d. Application
 - 1) Upon completion of the manufacturer's inspection of the installation and any identified corrections, the manufacturer may provide the Owner or purchaser with a limited warranty on manufacturer's products.
5. Valve Applications:
- a. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
 - 1) Shut-Off Duty: Use gate, and ball, valves.
 - 2) Throttling Duty: Use globe, ball, and plug valves.
 - b. Install drain valves at low points in mains, risers, branch lines, for system drainage.
 - c. Install pump discharge valves with stem in upward position; allow clearance above stem for check mechanism removal.
6. Hydronic Specialties Installation:
- a. Install automatic air vents at high points in the system, unit heater coils, and elsewhere as required for system air venting. Install air vents with cocks such that vents can be removed without draining system.
 - b. Install combination separator/strainer in pump suction lines. Run piping to compression tank with 1/4 in. per foot (2 percent) upward slope towards tank. Install blowdown piping with gate valve; extend to nearest drain.
 - c. Install pump suction diffusers on pump suction inlet, adjust foot support to carry weight of suction piping. Install nipple and ball valve in blowdown connection.
 - d. Install shot-type chemical feeders in chilled water hydronic system; in upright position with top of funnel not more than 48 in. above floor. Install feeder in bypass line, off main using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.

- e. Install diaphragm-type compression tanks as indicated. Vent and purge air from hydronic system, charge tank with proper air charge to suit system design requirements.
 - 1) In the absence of details provide support from the floor or structure above sufficient for the weight of water assuming a full tank of water. Do not overload building components and structural members.
- 7. Field Quality Control:
 - a. Preparation for Testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
 - 1) Leave joints including welds uninsulated and exposed for examination during the test.
 - 2) Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
 - 3) Flush system with clean water. Clean strainers.
 - 4) Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
 - 5) Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
 - b. Testing: Test hydronic piping as follows:
 - 1) Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used if it is safe for workmen and compatible with the piping system components.
 - 2) Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at point for complete removal of the liquid.
 - 3) Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
 - 4) Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test. Make a check to verify that the stress due to pressure at the bottom of vertical runs does not exceed either 90 percent of specified minimum yield strength, or 1.7 times the "SE" value in Appendix A of ASME B31.9, Code for Pressure Piping, Building Services Piping.
 - 5) After the hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connection for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

8. Adjusting and Cleaning:

- a. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens. After cleaning and flushing hydronic piping system, but before balancing, remove disposable fine mesh strainers in pump suction diffusers.
- b. Chemical Treatment: Provide a water analysis prepared by the chemical treatment supplier to determine the type and level of chemicals required for prevention of scale and corrosion. Perform initial treatment after completion of system testing.

I. INSTALLATION OF HVAC PUMPS

1. Vibration Control: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.
2. General: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized practices to ensure that HVAC pumps comply with requirements and serve intended purposes.
3. Access: Provide access space around HVAC pumps for service but in no case less than that recommended by manufacturer.
4. Support: Install base-mounted pump assembly on minimum of 4 in. high concrete base equal or greater than 3 times total weight of pump and motor. Set and level pump in base and grout with non-shrink grout.
5. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
 - a. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.
6. Adjusting and Cleaning
 - a. Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.
 - b. Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.
 - c. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

J. INSTALLATION OF TERMINAL HEATING UNITS (HYDRONIC)

1. Vibration Control: Refer to section 230548 and drawing VS101 for the appropriate support of each piece of HVAC equipment noted as requiring such. The vibration control manufacturer shall recommend the correct connection and device as outlined in section 230548 and drawing VS101.

2. Installation of Horizontal Unit Heaters: (Hydronic)
 - a. General: Install unit heaters as indicated, and in accordance with manufacturer's installation instructions.
 - b. Verify that nameplate data corresponds with unit designation.
 - c. Hang units from building substrate, not from piping. Mount as high as possible to maintain greatest headroom possible unless otherwise indicated.
 - d. Support units with rod-type hangers anchored to building substrate.
 - e. Install piping as indicated.
3. Adjusting and Cleaning:
 - a. General: After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.
 - b. Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.
 - c. Install new filter units for terminals requiring same.

3.34 AUTOMATIC TEMPERATURE CONTROLS (DDC)

- A. Installation Of Automatic Temperature Controls (DDC):
 1. Installation of Control Systems:
 - a. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.
 - b. Control Wiring: Install control wiring, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code.
 - 1) Install circuits over 25-volt with color-coded No. 12 wire in electric metallic tubing.
 - 2) Install circuits under 25-volt with color-code No. 18 wire with 0.031 in. high temperature 105 degrees F. (41 degrees C) plastic insulation on each conductor and plastic sheath over all.
 - 3) Install electronic circuits with color-coded No. 22 wire with 0.023 in. polyethylene insulation on each conductor with plastic-jacketed copper shield over all.
 - 4) Install low voltage circuits, located in concrete slabs, masonry walls, or in mechanical areas, in electrical conduit. Where exposed in occupied areas install all wiring in wiremold.
 - 5) Power sources from lighting circuits and wall outlets shall not be used to power DDC controllers.
 - c. Controllers and safety devices:
 - 1) All safety devices such as freezestats, duct mounted heat detectors, and smoke detectors shall be hard wired to shut down the fans independently. Provide audible alarm with silence switch as well as DDC indication.

- 2) All supply, return and exhaust fans shall be provided with pressure differential switches. Current sensing devices, starter auxiliary contacts, and relay contacts are unacceptable proof of fan operation.
 - 3) Primary and standby pumps shall be selectable through the DDC control system. Provide local pilot light to indicate selected pump as well as alarm and silence switch for failed pump. Provide differential pressure switch to prove flow.
2. Adjusting and Cleaning:
 - a. Start-Up: Start-up, test, and adjust DDC control systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.
 - b. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
 - c. Final Adjustment: After completion of installation, adjust thermostats, control valves, motor and similar equipment provided as work of this section.
 - 1) Final adjustment shall be performed by specially trained personnel in direct employ of manufacturer of primary temperature control system.
 3. Closeout Procedures:
 - a. Owner's Instructions: Provide services of manufacturer's technical representative for 40 hours of onsite instruction training on running and basic troubleshooting of DDC control system.
 - b. Validation: The automatic temperature control contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequence of operation submitted.
 - 1) Witnessed validation demonstration shall consist of:
 - a) Execute digital and analog commands in English and graphic mode.
 - b) Demonstrate all specified diagnostics.
 - c) Demonstrate scan, update, and alarm responsiveness.
 - 2) Comply with SECTION 019113 and 230800 – COMMISSIONING REQUIREMENTS.
 - c. Training:
 - 1) All training shall be by the automatic temperature control contractor and shall utilize specified manuals and as-built documentation.
 - 2) Operator training shall include:
 - a) Sequence of Operation review.
 - b) Sign on-Sign off.
 - c) Modifying warning limits, alarm limits and start-stop times.
 - d) System initialization.
 - e) Use of Portable Operators Terminal.

- f) Troubleshooting of sensors (determining bad sensors).
 - g) Point disable/enable.
 - h) Software review of Sequence of Operation programs.
 - i) Modification of control programs.
 - j) Add/Delete/Modify data points.
 - k) Use of diagnostics.
 - l) Review of initialization.
- 3) Training shall be for Owner-designated personnel at the subject site, and shall be scheduled by the Owner with two week notice.
- 4) All training sessions shall be videotaped by professional videographer, refer to architectural specifications for further requirements.
- d. Seasonal Site Visits:
- In addition to the one year warranty period, which shall commence upon project substantial completion, provide the following:
- 1) 40 hours of training and 80 hours of extra programming as it relates to the control system described in section 23 00 00 paragraph 2.30 & 3.32 and per control drawing requirements.
 - 2) The ATC contractor shall also provide a seasonal site visit to confirm, verify and modify as required the sequence and/or programming of each piece of equipment to ensure the system is functioning as required and per the sequence of operations. The ATC contractor shall provide 16 labor hours per season (four times within a year, total of 64 hours). During each visit they shall, for each piece of equipment confirm operation and functionality, modify and/or repair any control related issues and/or programming and provide training as requested by the owner. This requirement will ensure the equipment/building is operating properly and efficiently as it cycles through each season. These site visits shall begin the following season after substantial completion of the project is issued. Upon substantial completion the ATC Contractor shall issue four dates to the Engineer of Record and Owner. Signatures and time logs will be kept by both parties to ensure these visits occur.
- e. Perform Indoor Air Quality Management Building flush out procedures and adhere to IAQ Management Procedures referenced in Section 018119 – INDOOR AIR QUALITY REQUIREMENTS.

3.35 TESTING, ADJUSTING, AND BALANCING

A. REQUIREMENTS:

1. Requirements include verification of HVAC system operation, measurement of all system capacity, and establishment of the quantities of the mechanical systems as required to meet specifications, and recording and reporting the results.

2. The entire project is considered phased construction, and as such, as each phase of construction is completed the appropriate balancing for that phase of work shall be completed. At the completion of all phases of construction each previous phase of completed balancing must be re-checked and re-adjusted accordingly to match final design conditions. A preliminary report of each phase of construction will be submitted for approval during each phase of construction, and a final balancing report including all phases of construction will be submitted at the completion of the project.
3. Commission, test, adjust and balance the following mechanical systems:
 - a. Supply air systems.
 - b. Return air systems.
 - c. Exhaust air systems.
 - d. Outside air systems.
 - e. Hydronic heating hot water, dual temp water, condenser water, Cogen hot water and chilled water systems.
 - f. Verify temperature control system operation.
4. Do not include:
 - a. Testing boilers and pressure vessels for compliance with safety code.
 - b. Installation of adjusting and balancing devices. If devices must be added to achieve proper adjusting and balancing. Contact Mechanical Contractor and the Engineer for direction.
5. Comply with Commissioning Test Requirements in Section 019113 and 230800.
6. Comply with Indoor Air Quality Management Building flush out procedures and adhere to IAQ Management Procedures referenced in SECTION 018119 – INDOOR AIR QUALITY REQUIREMENTS.
 - a. All rooftop units shall operate at the maximum amount of outside air (the design outside airflow rate for maximum occupancy as indicated on the mechanical schedules) during and after the installation of VOC emitting materials for the maximum amount of time feasible, but not less than continuously (i.e. 24 hours) for seven days. During this time, the design temperature and humidity set points shall be maintained. The installation of VOC emitting materials shall be fully coordinated with the Architect.

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- b. If the project has fallen behind schedule and cannot run the equipment for the required period of time (24 hours for seven days), the flush-out can alternatively be performed while the building is occupied provided all of the following measures to protect building occupants are taken prior to their use of the space: percent
- 1) All of the rooms in the school must be inspected for health and thermal comfort by a trained technician or a certified Industrial Hygienist before occupancy. The occupancy evaluation report must be reviewed and approved by a certified Industrial Hygienist (i.e. certified by the American Council of Government and Industrial Hygienists (ACGIH) shall be submitted to LEED showing the following elements have been met at a minimum:
 - a) Each classroom has been tested to show that the ventilation rate meets minimum code required ventilation rate and receives continuous ventilation during occupancy, per Title 8, Sec 5142.
 - b) The HVAC filters on all HVAC units are properly in place and meet the MERV rating as specified for the project, the HVAC condensate pans drain correctly and internal HVAC insulation undamaged.
 - c) Each classroom has been tested to show that particulate matter, PM 10, has measured to be 20 micrograms per cubic meter or less than the outdoor air levels and the PM 2.5 12 micrograms per cubic meter or less than outdoor air levels.
 - d) Each classroom has been tested to show that the carbon monoxide has been measured and is less than 9 parts per million but not greater than 2 ppm above outdoor levels. Each classroom has been tested to show that the carbon dioxide has been measured and is less than 200 ppm above outdoor CO2 levels nearby. The room must be unoccupied during testing, and testing should occur during at least on rush-hour period.
 - e) Each classroom has been tested to show that the temperature and relative humidity have been measured and are within the criteria in the current ASHRAE Standard 55.
 - 2) Each classroom has been inspected and observed to ensure that there are no health or safety concerns from any chemical, moisture and odor sources in or near the classrooms.
 - a) Conduct the flush-out for 24 hours a day of continuous ventilation for a total of days necessary for all supply fans at their maximum rate and position. Thermal comfort is maintained during occupied hours, per the criteria in the current ASHRAE Standard 55. Internal temperatures are maintained at the most energy efficient level above 60 deg. F; relative humidity is maintained no higher than 60 percent during non-occupancy hours. Under conditions where the heating can't be met (60 deg. F) at that fan speed, then adjust the fan to meet the 60 deg. F.
 - b) All air handling unit dampers are at their maximum outdoor air position during the 14 day flush-out

- 3) Post-occupancy ventilation: When the contractor is required to perform touch-up (including furniture after occupancy) work involving products with chemical emissions, provide temporary construction ventilation during application and extend the building flush-out by a minimum of four days after touch-up application, with 100 percent tempered outside air for 24 hours each day.
 - c. All unit filters to be replaced upon completion of flush-out
- B. Report:
 1. Format: Report forms shall be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, three-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the below listed divisions, separated by divider tabs:
 - a. General Information and Summary.
 - b. Air Systems.
 - c. Hydronic heating, dual temp and cooling systems.
 - d. Temperature Control Systems.
 2. Contents: Provide the following minimum information, forms and data:
 - a. General Information and Summary: Inside cover sheet to identify testing, adjusting, and balancing agency, Contractor, Owner, Architect, Engineer, and Project. Include addresses, and contact names and telephone numbers. Also include a certification sheet containing the seal and name address, telephone number, and signature of the Certified Test and Balance Engineer. Include in this division a listing of the instrumentation used for the procedures along with the proof of calibration.
 - b. The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard report forms prepared by the AABC for each respective item and system.
 - c. Submit proof that all required instrumentation has been calibrated to tolerances specified in the referenced standards, within a period of six months prior to starting the project.
- C. QUALITY ASSURANCE:
 1. An independent testing, adjusting, and balancing agency certified by the AABC or NEBB as a Test and Balance Engineer in those testing and balancing disciplines required for this project.
 2. Codes and Standards:
 - a. AABC: "National Standards For Total System Balance".
 - b. ASHRAE: ASHRAE Handbook, 1984 Systems Volume, Chapter 37, Testing, Adjusting, and Balancing.

3. Pre-Balancing Conference: Prior to beginning of the testing, adjusting, and balancing procedures, schedule and conduct a conference with the Architect/Engineer and Mechanical Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.
4. System Operation: Systems shall be fully operational prior to beginning procedures. All new automatic temperature controls shall be fully operational. Test, adjust and balance the air systems before refrigerant systems. Test, adjust and balance air conditioning systems during summer season, and heating systems during winter season, including at least a period of operation at outside conditions within 5E F. wet bulb temperature of maximum summer design condition, and within 10E F. dry bulb temperature of minimum winter design condition. Take final temperature reading during seasonal operation.
5. Test all fume hoods in accordance with ANSI/ASHRAE 110 Standards. Balancer shall record and report all data and adjust fan sheaves, dampers etc. as required to achieve desired velocities and air flows.

D. PRELIMINARY PROCEDURES:

1. Air Systems:
 - a. Obtain drawings and become thoroughly acquainted with the systems.
 - b. Compare drawings to installed equipment and field installations.
 - c. Walk the system from the system air handling equipment to terminal units to determine variations in installation.
 - d. Check filters for cleanliness.
 - e. Check all dampers (volume and fire) for correct and locked position, and temperature control for completeness of installation before starting fans.
 - f. Prepare report test sheets for both fans and outlets. Obtain manufacturer's outlet factors and recommended procedures for testing. Prepare a summation of required outlet volumes to permit a cross check with required fan volumes.
 - g. Determine best locations in main and branch ductwork for most accurate duct traverses. Traverses shall be performed in each supply and return duct main and sub-mains for each AHU and return air fan.
 - h. Place outlet dampers in the full open position.
 - i. Prepare schematic diagrams of system "as-built" ductwork and piping layouts to facilitate reporting.
 - j. Verify lubrication of all motors and bearings.
 - k. Check fan belt tension.
 - l. Check fan rotation.
2. Hydronic Systems:
 - a. Open valves to full open position. Close coil bypass valves.
 - b. Remove and clean all strainers.
 - c. Examine hydronic systems and determine if water has been treated and cleaned.
 - d. Check pump rotation.

- e. Check expansion tanks to verify noted air pressure and that the system is completely full of water.
 - f. Check air vents at high points of system and determine if all are installed and operating freely.
 - g. Set temperature controls so all coils are calling for full flow.
 - h. Check operation of automatic bypass valves.
 - i. Check and set operating temperatures of chillers, boilers, and heat exchangers to design requirements.
 - j. Verify lubrication of all motors and bearings.
3. Measurements:
- a. Provide all required instrumentation to obtain proper measurements, calibrated to the tolerance specified in the referenced standards. Instruments shall be properly maintained and protected against damage.
 - b. Provide instruments meeting the specifications of the referenced standards.
 - c. Use only those instruments which have the maximum field measuring accuracy and are best suited to the function being measured.
 - d. Apply instrument as recommended by the manufacturer.
 - e. Use instruments with minimum scale and maximum subdivisions and with scaled ranges proper for the value being measured.
 - f. When averaging values, take a sufficient quantity of readings which will result in a repeatability error of less than 5 percent. When measuring a single point, repeat readings until 2 consecutive identical values are obtained.
 - g. Take all reading with the eye at the level of the indicated value to prevent parallax.
 - h. Use pulsation dampeners where necessary to eliminate error involved in estimating average of rapidly fluctuation readings.
 - i. Take measurements in the system where best suited to the task.

E. Performing Testing, Adjusting, and Balancing:

- 1. Test, adjust and balance all noted systems according to SMACNA standards and as follows:
 - a. Perform testing and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards.
 - b. Cut insulation and ductwork for installation of test probes to the minimum extent necessary to allow adequate performance of procedures.
 - c. Patch insulation, ductwork, and housings, using materials identical to those removed.
 - d. Seal ducts and test for and repair leaks.
 - e. Seal insulation to re-establish integrity of the vapor barrier.

- f. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings. Mark with paint or other suitable, permanent identification materials.
 - g. Retest, adjust and balance system subsequent to significant system modifications, and resubmit test results.
2. System Deficiencies:
- a. The Balancing Contractor shall advise the Mechanical Contractor and the Engineer of all system deficiencies in writing. Report all motors not running, missing dampers, inoperative valves and controls, or lack of access.
 - b. Upon completion of system deficiencies, Balancing Contractor shall balance and record data. Again at no additional cost to the Project/Owner.
 - c. Any re-balancing required to meet the desired CFM or modified CFM due to system modifications or owner changes shall be provided at no additional costs to the Project/Owner.
 - d. The balancing sub-subcontractor shall provide the necessary sheave and belt changes/modifications to motors/fans as required to achieve the desired CFM at no additional costs to the Project/Owner.

End of Section

Section 23 00 01

HEATING, VENTILATING, AND AIR CONDITIONING TRADE CONTRACT REQUIREMENTS
(TRADE CONTRACT REQUIRED)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. The BIDDING REQUIREMENTS, CONTRACT FORMS, and CONTRACT CONDITIONS as listed in the Table of Contents, and applicable parts of Division 1 - GENERAL REQUIREMENTS, shall be included in and made a part of this Section.

1.2 PUBLICLY BID TRADE CONTRACTOR

- A. The work of this section pertains to a Publicly Bid Trade Contract and includes the following requirements:
1. Specification requirements for Trade Contract "HEATING, VENTILATING, AND AIR CONDITIONING" include all of the following listed Specification Sections: in their entirety:
 - a. Section 23 00 01 – HEATING, VENTILATING, AND AIR CONDITIONING TRADE CONTRACT REQUIREMENTS.
 - b. Section 23 00 00 - HVAC
Section 23 00 01 - HEATING VENTILATING AND AIR CONDITIONING TRADE CONTRACT REQUIREMENTS
 - c. Section 23 05 48 - VIBRATION CONTROL AND SEISMIC RESTRAINT
 - d. Section 23 08 00 - COMMISSIONING OF HVAC
- B. Submit bid as directed by and in compliance with the Invitation to Bid, the Instructions to Bidders, and this Article 1.2 - PUBLICLY BID TRADE CONTRACTOR
- C. Submit bid on mandatory form, and in manner described in the Instructions to Bidders before the date and time indicated for submission of bids.
- D. The Trade Contractor shall perform the complete trade work, including the following listed sub-trade classes of work, with employees on its own payroll unless the Trade Contractor identifies on the bid form, the name of a sub-trade subcontractor that will perform each of the following classes of sub-trade work and the corresponding sub-trade subcontract sum.

CLASSES OF WORK	SECTION 23 00 00 REFERENCE PARAGRAPHS
Insulation	2.6, 2.7, 3.7, 3.8
Sheetmetal & Accessories	2.19, 2.20, 2.21, 2.22, .2.23, 2.24, 3.20 3.21, 3.22, 3.23, 3.24, 3.25
Automatic Temperature Controls	2.33, 3.34
Air and Water Balancing	3.35

- E. If the Trade Contractor intends to use sub-trade subcontractors to perform any portion of the trade work other than the customary sub-trade classes of work listed

in Paragraph 1.2(D), above, the Trade Contractor shall list on the bid form the names of each such sub-trade subcontractor and each respective sub-trade subcontract sum unless: (a) the value of the sub-trade subcontract is less than Twenty-Five Thousand Dollars (\$25,000), or (b) the sub-trade subcontract is not subject to the provisions of M.G.L. c. 149, §§ 44A-J.

- F. The work to be completed by the Trade Contractor for the work of this Section is shown on the following listed Drawings:
1. The Work of this Trade Contract is shown on the following Drawings:
A001, A101, A102, A103, A200, A544, S000, S101C, S102C, S103C, S104C, LS001, LS101, LS102, LS103, A410, A411, A412, A413, A414, A415, A416, A417, A418, A419, A420, A421, A425, A440, A441, A426, A181, A181A, A181B, A181C, A181D, A182, A182A, A182B, A182C, A182D, A183, A183A, A183B, A183C, A101A, A101D, A700, A453, A211, A201, A212, A202, A213, A203, A214, A204, A215, A205, TE000, TE001, TE111, TE112, TE121, TE122, TE141, FS100, FS101, FS102, FS103, S302, S001, S002, S003, S101A, S101B, S101D, S101L, S102A, S102B, S102D, S103A, S103B, S103D, S104B, S104D, S105B, S105C, S200, S201, S202, S203, S204, S205, S300, S301, S303, S304, S305, S400, S401, S500, S501, S502, S503, S504, S600, S601, S602, S603, S604, S700, S701, VS101, A104, A480, A600, A461, A602, A450, A460, A111A, A422, A423, A427, A431, A433, A434, A690, A451, A691, A452, A002, A715, A112C, A113C, A114C, A429, A141D, A430, A435, A601, A318, A522, M101A, M101B, M101C, M101D, M102A, M102B, M102C, M102D, M103A, M103B, M103C, M103D, M201A, M201B, M201C, M201D, M202A, M202B, M202C, M202D, M203A, M203B, M203C, M203D, A621, A463, A530, A531, A462, A111D, A112A, A112B, A113A, A113B, A113D, M104, M408, A114B, M001, M002, M301, M302, M303, M304, M305, M401, M402, M403, M404, M405, M406, M407, M409
 2. The complete List of Drawings for the Project is provided on the Cover Sheet of Contract Drawings.
 3. Examine all Drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section The listing of Contract Drawings above does not limit Trade Contractor's responsibility to determine full extent of work of this Section as required by all Drawings listed in the Drawing List on the Drawing Title Sheet, as modified by Addenda.
- G. Refer to Section 01 23 00 - ALTERNATES, for Bid alternates which may affect the scope of Work of this Trade.
- H. Trade Contracts for work under this Section shall be for the complete work and shall be filed in a sealed envelope with the Awarding Authority at a time and place as stipulated in INVITATION TO BID and INSTRUCTIONS TO BIDDERS.
1. The following shall appear on the upper left hand corner of the envelope:

NAME OF TRADE
CONTRACTOR: _____
TRADE CONTRACT FOR TRADE: HEATING, VENTILATING,
AND AIR CONDITIONING.
 2. Each Trade Contract submittal for work under this Section shall be on forms furnished by Awarding Authority, as bound herein, accompanied with the

required bid deposit in compliance with MGL Chapter 149 Section 44B in the amount of 5 percent of Trade Contract.

1.3 RELATED REQUIREMENTS

- A. Section 07 72 36 - SMOKE VENTS.
- B. Section 08 90 00 - LOUVERS AND VENTS.
- C. Section 11 40 00 - FOODSERVICE EQUIPMENT.
- D. Section 11 53 13 - LABORATORY FUME HOODS.
- E. Section 21 00 00 - FIRE PROTECTION
- F. Section 22 00 00 - PLUMBING
- G. Section 23 00 00 - HVAC
- H. Section 23 00 01 - HEATING VENTILATING AND AIR CONDITIONING TRADE Contract REQUIREMENTS
- I. Section 23 05 48 - VIBRATION CONTROL AND SEISMIC RESTRAINT
- J. Section 23 08 00 - COMMISSIONING OF HVAC
- K. Section 26 00 01 –ELECTRICAL TRADE CONTRACT REQUIREMENTS.
- L. Section 26 00 10 - ELECTRICAL

1.4 EXAMINATION OF SITE AND DOCUMENTS

- A. Bidders are expected to examine and to be thoroughly familiar with all contract documents and with the conditions under which work will be carried out. The Awarding Authority (Owner) will not be responsible for errors, omissions and/or charges for extra work arising from Construction Manager or Trade Contractor's failure to familiarize themselves with the Contract Documents or existing conditions. By submitting a bid, the Bidder agrees and warrants that he has had the opportunity to examine the site and the Contract Documents, that he is familiar with the conditions and requirements of both and where they require, in any part of the work a given result to be produced, that the Contract Documents are adequate and that he will produce the required results.

1.5 MEETINGS AND CONFERENCES

- A. Pre-Bid Conference: Trade Contractors are strongly encouraged to attend the Pre-Bid Conference; refer to INVITATION TO BID for date and time.

1.6 SEQUENCING

- A. Coordinate work of this Trade Contract with that of other trades, affecting or affected by this work, and cooperate with the other trades as is necessary to assure the steady progress of work.

- B. Do not order or deliver any materials until all submittals, required in the listed Specification Sections included as part of this Trade Contract, have been received and approved by the Architect.
- C. Before proceeding with installation work, inspect all project conditions and all work of other trades to assure that all such conditions and work are suitable to satisfactorily receive the work of this Section and notify the Architect in writing of any which are not. Do not proceed further until corrective work has been completed or waived.

PART 2 - PRODUCTS

2.1 SCAFFOLDS AND STAGING

- A. General: Trade Contractors shall obtain required permits for, and provide scaffolds, staging, and other similar raised platforms, required to access their Work as specified in the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS and herein.
 - 1. Scaffolding and staging required for use by this Trade Contractor pursuant to requirements of the Construction Manager's GENERAL PROJECT REQUIREMENTS – APPLICABLE TO ALL TRADE AND NON-TRADE SUBCONTRACTORS shall be furnished, erected, maintained in a safe condition, and dismantled when no longer required, by this Trade Contractor requiring such scaffolding.
 - 2. Each Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager.
 - 3. Furnishing portable ladders and mobile platforms of all required heights, which may be necessary to perform the work of this trade, are the responsibility this Trade Contractor.
- B. Weather protection and temporary enclosures: Comply with requirements of Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and the following:
 - 1. Each individual Trade Contractor is responsible to provide, maintain and remove at dismantling, all tarpaulins and similar protective measures necessary to cover scaffolding for inclement weather conditions other than those required to be provided, maintained and removed by the Construction Manager pursuant to MGL (Refer to Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS and as additionally required for dust control).
 - a. Construction Manager is responsible to provide, maintain and remove temporary enclosures of the work from November 1, to March 31 pursuant to Mass. General Laws.
 - b. Trade Contractor is responsible to provide, maintain and remove temporary enclosures of the work for protection from inclement weather from April 1, to October 31, at no additional cost to the Owner.

2.2 HOISTING MACHINERY AND EQUIPMENT

- A. All hoisting equipment, rigging equipment, crane services and lift machinery required for the work by this Trade Contractor shall be furnished, installed,

operated and maintained in safe conditions by this Trade Contractor, as referenced under Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

PART 3 - EXECUTION (Not Used)

End of Section

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VIBRATION CONTROL AND SEISMIC RESTRAINT
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Section 23 05 48

VIBRATION CONTROL AND SEISMIC RESTRAINT

(TRADE CONTRACT REQUIRED AS PART OF SECTION 23 00 01 & 26 00 01)

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Trade Contract: As provided under Section 23 00 01 – HEATING, VENTILATING AND AIR-CONDITIONING TRADE CONTRACT REQUIREMENTS and 26 00 00 – ELECTRICAL TRADE CONTRACT REQUIREMENTS and supplemented under the Bidding Requirements, Contract Forms, and Conditions of the Contract, and applicable parts of Division 1 - GENERAL REQUIREMENTS.
 - 1. Work of this Trade Contract includes all individual specification sections listed in Section 23 00 01 & Section 26 00 01.

1.2 DESCRIPTION OF WORK

- A. General: The work noted within Section 23 05 48 is referenced by Divisions 23 00 00 and 26 00 00. Provide all necessary labor & material in each division as required herein.
- B. Intent:
 - 1. All mechanical, plumbing, fire protection & electrical equipment, piping, conduits and ductwork shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
 - 2. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.
 - 3. It is the intent of the seismic portion of this specification to keep all mechanical, plumbing, fire protection and electrical building system components in place during a seismic event.
 - 4. All such systems must be installed in strict accordance with seismic codes, component manufacturer's, and building construction standards. Whenever a conflict occurs between the manufacturer's or construction standards, the most stringent shall apply.
 - 5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
 - 6. Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

- C. The work in this section includes, but is not limited to the following:
1. Vibration isolation for piping, conduits, ductwork and equipment.
 2. Equipment isolation bases.
 3. Flexible piping connections.
 4. Seismic restraints for isolated equipment.
 5. Seismic restraints for non-isolated equipment.
 6. Certification of seismic restraint designs and installation supervision.
 7. Certification of seismic attachment of housekeeping pads.
 8. All mechanical, plumbing, fire protection and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included. Equipment referred to below is typical. (Equipment not listed is still included in this specification).

AC Units	Generators
Air Cooled Condensing Units	Heat Exchangers
Air Handling Units	Light Fixtures
Air Separators	Motor Control Ctrs
Battery Racks	Piping
Boilers	Pumps (all types)
Bus Ducts	Rooftop Units
Cable Trays	Switching Gear
Absorption Chillers	Tanks (all types)
Comp. Room Units	Transformers
Conduit	Unit Heaters
Cooling Towers	Unit Substations
Ductwork	Var. Freq. Drives
Dust Collectors	VAV Boxes
Electrical Panels	Water Heaters
Fans (all types	Combined Heat and Power modules

- D. Definitions:
1. Life Safety Systems
 - a. All systems involved with fire protection including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, water tanks, fire dampers and smoke exhaust systems.
 - b. All systems involved with and/or connected to emergency power supply including all generators, transfer switches, transformers, and all flowpaths to fire protection and/or emergency lighting systems.
 - c. All medical and life support systems.
 - d. Fresh air & relief systems on emergency control sequence including air handlers, conduit, duct, dampers, etc.

2. Positive Attachment
 - a. A positive attachment is defined as a cast-in anchor, a drill-in wedge anchor, a double-sided beam clamp loaded perpendicular to a beam, or a welded or bolted connection to structure. Single sided "C" type beam clamps for support rods of overhead piping, ductwork, fire protection, electrical conduit, bus duct, or cable trays, etc. are not acceptable as seismic anchor points.
3. Transverse Bracing
 - a. Restraint(s) applied to limit motion perpendicular to the centerline of the pipe, duct or conduit.
4. Longitudinal Bracing
 - a. Restraint(s) applied to limit motion parallel to the centerline of the pipe, duct or conduit.

1.3 SUBMITTAL DATA REQUIREMENTS

- A. In addition to requirements of Section 01 33 00, the manufacturer of vibration isolation and seismic restraints shall provide submittals for products as follows:
 1. Descriptive Data
 - a. Catalog cuts or data sheets on vibration isolators and specific restraints detailing compliance with the specification.
 - b. Detailed schedules of flexible and rigidly mounted equipment, showing vibration isolators and seismic restraints by referencing numbered descriptive drawings.
 2. Shop Drawings
 - a. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations.
 - b. Provide all details of suspension and support for ceiling hung equipment.
 - c. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
 - d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
 3. Seismic Certification and Analysis
 - a. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.

- b. All restraining devices shall have a pre-approval number from California OSHPD or some other recognized government agency showing maximum restraint ratings. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 450 to the weakest mode.
- c. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces required acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.

1.4 CODE AND STANDARDS REQUIREMENTS

- A. Typical Applicable Codes, Standards, and Categories:
 - 1. International Building Code 2015 with an effective peak acceleration coefficient of 0.15.
 - 2. Massachusetts State Building Code, Ninth Edition.
 - 3. Seismic hazard exposure group of I, II, III and seismic performance category of C, D.
 - 4. If the building is a Seismic Design Category B, seismic restraints are not required for any mechanical, electrical and plumbing systems. Vibration isolation is still required for all mechanical, electrical and plumbing systems.

1.5 MANUFACTURER'S RESPONSIBILITY

- A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
 - 1. Determine vibration isolation and seismic restraint sizes and locations.
 - 2. Provide vibration isolation and seismic restraints.
 - 3. Provide calculations and materials if required for restraint of unisolated equipment.
 - 4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.6 RELATED WORK

- A. Housekeeping Pads:
 - 1. Housekeeping pads shall be coordinated with restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.

- B. Supplementary Support Steel:
 - 1. Contractor shall supply supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment.
- C. Attachments:
 - 1. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

1.7 DESIGN REQUIREMENTS

- A. Design isolators for equipment installed outdoors to provide adequate restraint to withstand the force of a 100 mph wind applied to any exposed surface of the isolated equipment. Isolators for outdoor equipment shall have bolt holes for attachment to equipment and to supports. The vibration isolation Vendor shall submit verifying shear and over turning calculations, for their product and equipment installation arrangement, stamped by a licensed Professional Engineer. The design and supply of miscellaneous support steel above and below isolators will not be the responsibility of the vibration isolation manufacturer.

1.8 QUALITY ASSURANCE

- A. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate plan dimensions with size of housekeeping pads.
- B. Provide vibration isolators of the appropriate sizes, with the proper loading to meet the specified deflection requirements.
- C. Supply and install any incidental materials such as mounting brackets, attachments and other accessories as may be needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim for additional payment.
- D. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- E. Should any rotating equipment cause excessive noise or vibration when properly installed on the specified isolators, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

PART 2 - PRODUCTS

2.1 INTENT

- A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. Mason Industry's products are the basis of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification.

- B. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 inch and/or horizontal permanent deformation greater than 1/4 inch.

2.2 PRODUCT DESCRIPTIONS

- A. Vibration Isolators and Seismic Restraints.

GENERAL:

1. All metal parts installed out-of-doors shall be corrosion resistant after fabrication. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.
2. Isolators installed out-of-doors shall have base plates with bolt holes for fastening the isolators to the support members.
3. Isolator types are scheduled to establish minimum standards. At the Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar installation advantages. Accessories and seismic restraint features must not degrade the isolation performance of the isolators.
4. Static deflection of isolators shall be as provided in the EXECUTION section and as shown on the drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected solely on the basis of rated deflections are not acceptable and will be disapproved.

SPECIFICATION:

1. Two layers of 3/4" thick neoprene pad consisting of 2" square waffle modules separated horizontally by a 16 gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be Type Super "W" as manufactured by Mason Industries, Inc.
2. Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2" and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be Type BR as manufactured by Mason Industries, Inc.
3. Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be type PB as manufactured by Mason Industries, Inc.

4. A one (1) piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be type HG as manufactured by Mason Industries, Inc.
5. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be Type SLF as manufactured by Mason Industries, Inc.
6. Restrained spring mountings shall have an SLF mounting as described in Specification 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall have Anchorage Pre-approval "R" Number from OSHPD in the state of California certifying the maximum certified horizontal and vertical load ratings. Mountings shall be SLR as manufactured by Mason Industries, Inc.
7. Spring mountings as in specification 5 built into ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4 inch travel in all directions before contacting the resilient snubbing collars. Mountings shall have an Anchorage Pre-approval "R" number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Mountings shall be SSLFH as manufactured by Mason Industries, Inc.
8. Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8". Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be Type MT and leveling valves Type LV as manufactured by Mason Industries, Inc.

9. Restrained air spring mountings shall have an MT air spring as described in Specification 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2" shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be SLR-MT as manufactured by Mason Industries, Inc.
10. Hangers shall consist of rigid steel frames containing minimum 1 1/4" thick neoprene elements at the top and a steel spring with general characteristics as in specification 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30° capability. Hangers shall be type 30° as manufactured by Mason Industries, Inc.
11. Hangers shall be as described in specifications 10, but they shall be pre-compressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30° capability. Hangers shall be type PC30N as manufactured by Mason Industries, Inc.
12. Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables must not be allowed to bend across sharp edges. Cable assemblies shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified load ratings. Cable assemblies shall be Type SCB at the ceiling and at the clevis bolt, SCBH between the hanger rod nut and the clevis or SCBV if clamped to a beam all as manufactured by Mason Industries, Inc.
13. Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage pre-approval "R" number from OSHPD in the state of California verifying the maximum certified load ratings. Solid seismic brace assemblies shall be type SSB as manufactured by Mason Industries, Inc.

Note: Specifications 12 - 14 apply to trapeze as well as clevis hanger locations. At trapeze anchor locations piping must be shackled to the trapeze. Specifications apply to hanging equipment as well.

14. Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California. Rod clamp assemblies shall be Type SRC as manufactured by Mason Industries, Inc.
15. Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose performed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California. Clevis cross brace shall be type CCB as manufactured by Mason Industries, Inc.
16. All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch thick. Rated loading shall not exceed 1,000 psi. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall have an Anchorage Pre-approval "R" Number from OSHPD in the State of California verifying the maximum certified horizontal and vertical load ratings. Snubber shall be Type Z-1 225 as manufactured by Mason Industries, Inc.
17. All directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4" thick. Rated loadings shall not exceed 1,000 psi. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8" nor more than 1/4". Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8" deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable "G" force. Submittals shall include the load deflection curves up to 1/2" deflection in the x, y and z planes. Snubbers shall have an anchorage pre-approval "R" number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be series Z-101 1 as manufactured by Mason Industries, Inc.
18. Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is "rolled up" to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the I.C.B.0 Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be type SAS as manufactured by Mason Industries, Inc.
19. Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the I.C.B.0 Evaluation Service, Inc. verifying to its allowable loads. Drill-in female wedge anchors shall be type SAB as manufactured by Mason Industries, Inc.

20. Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14' provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1 ". Bases shall be type WF as manufactured by Mason Industries, Inc.
21. Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Bases shall be a minimum of 1/1 2 of the longest dimension of the base but not less than 6". The base depth need not exceed 1 2" unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" bars welded in place on 6" centers running both ways in a layer 1 1/2" above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1 " clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.
22. Roof Curb (by HVAC Contractor)
 - a. Curb mounted rooftop equipment shall be mounted on structural spring isolation curbs that bear directly on the roof support structure, and are flashed and waterproofed into the roof's membrane waterproofing system. All spring locations shall have removable waterproof covers to allow for spring adjustment and/or removal. Springs shall be Type A.
 - b. Unit shall be provided with wood nailer and flashing.
 - c. Curbs shall meet all NRCA Standards.
 - d. Curbs shall be similar to Novia Associates VibCurb III or equal having a minimum 3" rated static deflection and be 24" high.
 - e. Vibration control: The spring roof curb shall have the top isolated or floating rail attached in a manner to the fixed lower portion of the curb without short circuiting or bridging between the two. Restraining bolt(s) or threaded rod shall be of sufficient size to withstand the applied wind & seismic forces at each spring pack location.
 - f. An alignment bolt shall be installed before connecting the floating to non-floating parts to guarantee perfect centering of the restraining bolts.
 - g. Weather proofing & air seal: The spring curb must keep the weather (air and water) out and any airflow from the RTU in. The weather seal must not have the ability to fail and allow water or air into the building.
 - h. The use of exposed exterior neoprene or some other elastomer material to seal the top floating rail from the base of the curb in not acceptable.

- i. Vibration Mountings: Provide a rubber gasket covered by formed galvanized sheet metal top flashing that overhangs the top wood nailer and galvanized bottom flashing. The overlapping shall effectively cover the rubber gasket so it is protected from the elements.
- j. The top flashing / support rail shall be 14 ga. G60-Zc steel formed with 90 bends that extend down to the wood nailer. Provide a counter flashing member with a sponge gasket attached that presses up against the horizontal bend. The seal shall be replaceable, protected from the elements and easy to install.
- k. Curb side material: Provide 12 Ga. G60 galvanized steel for curb side construction. All side and end seam between sheets shall be continuously welded, corner joints to be caulked and bolted.
- l. Structural Capability:
 - 1) Curbs shall be installed on metal decking/concrete slab. Air handling unit load shall be properly distributed. Coordinate curb construction with pitch of roof. Curbs shall be built to match the roof pitch in accordance with all requirements of this project. Positive attachment of the curb to the structure is imperative. Pitch correction shall be fabricated from 12 gauge galvanized material and be continuous on all sides and ends. Field fabricated and installed tube steel stub-ups are not acceptable. HVAC contractor shall provide detailed information to the curb manufacturer regarding pitch correction.
 - 2) Plenum Sections: The side material must be capable of handling the static pressure developed by the fans and not 'oil can'. Provide spanning bar joists as required to support plenum installation (even when the spring pockets are center span).
 - 3) Provide a continuous bottom tube steel member or side material of sufficient strength. Mechanical contractor shall coordinate and verify all dimensions, weights, roof penetrations, etc. with the Structural Engineer prior to installation.
 - 4) Curb Insulation: Provide spring curbs with a space between the floating and non-floating parts for the installation of insulation. Curb manufacturer shall provide factory installed insulation adhered to roof curb. Curbs shall be externally factory insulated with a 1.7" thick R-12 foam insulation, FM Class 1 and UL Class A Ratings, with bonded fiber reinforced facer.
- m. Protection: Curbs shall be completely shrink-wrapped during shipping.
- n. Mechanical contractor shall provide all necessary materials to completely weather proof and sound proof the curb installation.

-
- o. Additional features:
- 1) Sound barrier: Provide a sound barrier package, consisting of G60 galvanized back-to-back angles. Sound barrier package shall be capable of supporting two layers of 1/2" concrete board with a maximum deflection over the width of the curb of L/360. Cement board furnished and installed by the HVAC Contractor. Overlap all joints, caulk all seams and edges. Transmission Loss & STC shall be as shown as follows. Sound Transmission Loss at Frequency (Cycles per second) of (125)=20, (250)=27, (500)=30, (1000)=32, (2000)=30, (4000)=38, (STC)=31.
 - 2) Provide with framed Supply & Return air duct openings. Openings shall match duct sizes and have 1" galvanized steel flanges.
 - 3) Plenum sections: Where indicated on the drawings and/or if substituted equipment connections differ from what's on the contract documents, provide in the interior of the curb, double wall acoustical floor, walls and plenum divider. All insulation shall be 2" thick fiber glass acoustical duct liner with reinforced coating system. Insulation acoustical performance shall be as follows. Liner shall not support microbial growth and shall be EPA registered and pass ASTM C 1071 & ASTM G21 bacterial tests conducted in accordance with ASTM G22. Floors up to 90" curb I.D. width shall be constructed of 22 Ga., 20 Ga. thereafter, solid G60 galvanized bottom panels and 22 Ga. galvanized perforated 22.7% open area top panel. Floor shall be attached to walls and plenum divider to provide an airtight plenum. Walls shall have 22 Ga. galvanized perforated 22.7% open area inside panels. Plenum divider shall be double wall 22 Ga. perforated galvanized 22.7% open area panel on the supply side with a 14 gauge solid panel opposite. Sound Absorption Coefficient at Frequency (Cycles per second) of (125)=.23, (250)=.64, (500)=.99, (1000)=1.05, (2000)=1.00, (4000)=.98, (NRC)=.90,
23. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Dacron tire cord friction ring. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2" and larger shall have two spheres reinforced with a ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16' to 24" may be single sphere. Sizes 3/4" to 1 1/2" may have threaded bolted flange assemblies, one sphere and cable retention. 14" and smaller connectors shall be rated at 250 psi up to 190°F. with a uniform drop in allowable pressure to 190 psi at 250°F. 16" and larger connectors are rated 180 psi at 190°F. and 135 psi at 250°F. Safety factors to burst and flange pullout shall be a minimum of 3/1.
- All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods, as control rods are not desirable in seismic work. If control rods are used, they must have 1/2" thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi maximum on the washer area. Expansion joints shall be installed on the equipment side of the shut off valves.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

24. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Minimum lengths shall be as tabulated:

<u>Flanged</u>		<u>Male Nipples</u>	
3 x 14	10 x 26	1/2 x 9	1-1/2 x 13
4 x 15	12 x 28	3/4 x 10	2 x 14
5 x 19	14 x 30	1 x 11	2-1/2 x 18
6 x 20	16 x 32	1-1/4 x 12	
8 x 22			

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS as manufactured by Mason Industries, Inc.

25. All-directional acoustical pipe anchor, consisting of two sizes of steel tubing separated by a minimum 1/2" thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.
26. Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of + 1 5/8" motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.

27. Split Wall Seals consist of two bolted pipe halves with minimum 3/4" thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" past either face of the wall. Where temperatures exceed 240°F., 10# density fiberglass may be used in lieu of the sponge. Seals shall be Type SWS as manufactured by Mason Industries, Inc.
28. The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in specification 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4" movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the duct work or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be type WBI/WBD as manufactured by Mason Industries, Inc.

PART 3 - EXECUTION

3.1 GENERAL

- A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data. At the completion of all construction work the vibration and seismic device supplier shall inspect all installations and provided a written report of installation compliance to the engineer of record. A copy of this written certification shall also be provided in the operations manual provided to the owner.
- B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.
- C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- E. Coordinate work with other trades to avoid rigid contact with the building.
- F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractors expense.
- G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractors expense.

- H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractors expense.
 - I. Overstressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
 - 1. Flanges of structural beams.
 - 2. Upper truss cords in bar joist construction.
 - 3. Cast in place inserts or wedge type drill-in concrete anchors.
 - J. Specification 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
 - K. Specification 12 cable assemblies are installed taut on non-isolated systems. Specification 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
 - L. At locations where specification 12 or 13 restraints are located, the support rods must be braced when necessary to accept compressive loads with specification 14 braces.
 - M. At all locations where specification 12 or 13 restraints are attached to pipe clevis's, the clevis cross bolt must be reinforced with specification type 15 braces.
 - N. Drill-in concrete anchors for ceiling and wall installation shall be specification type 18, and specification type 19 female wedge type for floor mounted equipment.
 - O. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.
 - P. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24" or specified movements exceed specification 23 capabilities.
 - Q. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide specification 27 wall seals.
 - R. Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be specification type 28.
 - S. Locate isolation hangers as near to the overhead support structure as possible.
- 3.2 VIBRATION ISOLATION AND SEISMIC RESTRAINT OF PIPING, DUCTWORK, AND CONDUIT
- A. Where piping connects to rotating or vibrating mechanical equipment install specification 23 expansion joints or specification 24 stainless hoses if 23 is not suitable for the service.

B. Seismic Restraint of Piping:

1. Seismically restrain all piping listed as a, b or c below. Use specification 12 cables.
 - a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping.
 - b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1 1/4" I.D. and larger.
 - c. All other piping 2 1/2" diameter and larger.
1. Transverse piping restraints shall be at 40' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
2. Longitudinal restraints shall be at 80' maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
3. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
4. For fuel oil and all gas piping transverse restraints must be at 20' maximum and longitudinal restraints at 40' maximum spacing.
5. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24" of the elbow or TEE or combined stresses are within allowable limits at longer distances.
6. Hold down clamps must be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
7. Branch lines may not be used to restrain main lines.

C. Pipe Isolation

1. All chilled water, condenser water, hot water, steam, refrigerant, drain and engine exhaust piping that is connected to vibration-isolated equipment shall be isolated from the building structure within the following limits:
 - Within mechanical rooms;
 - Within 50' total pipe length of connected vibration-isolated equipment (chillers, pumps, air handling units, pressure reducing stations, etc.);
 - At every support point for piping that is greater than 4 inches in diameter.
2. Piping shall be isolated from the building structure by means of vibration isolators, resilient lateral supports, and resilient penetration sleeve/seals.
3. Isolators for the first three support points adjacent to connected equipment shall achieve one half the specified static deflection of the isolators supporting the connected equipment. When the required static deflection of these isolators is greater than 1/2", Type FSN or HSN isolators shall be used. When the required static deflection is less than or equal to 1/2", Type FN or HN isolators shall be used. All other pipe support isolators within the specified limits shall be either Type FN or HN achieving at least 1/4" static deflection.

4. Where lateral support of pipes is required within the specified limits, this shall be accomplished by use of resilient lateral supports.
5. Pipes within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
6. Provide flexible pipe connections as called for under Major Equipment above and wherever shown on the drawings.

D. Seismic restraint of ductwork:

1. Seismically restrain all duct work with specification 12 or 13 restraints as listed below:
 - a. Restrain rectangular ducts with cross sectional area of 6 sq. ft. or larger.
 - b. Restrain round ducts with diameters of 28" or larger.
 - c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
 - 1) Transverse restraints shall occur at 30' intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct turn and at each end of a duct run.
 - 2) Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
 - 3) The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
 - 4) A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
 - 5) Walls, including gypsum board non bearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

E. Duct Isolation:

1. All sheet metal ducts and air plenums that are within mechanical rooms or within a distance of 50' total duct length of connected vibration-isolated equipment (whichever is longer) shall be isolated from the building structure by Type FN, PCF or HN isolators. All isolators shall achieve 0.1" minimum static deflection.
2. Ducts within the specified limits that penetrate the building construction shall be isolated from the building structure by use of resilient penetration sleeve/seals.
3. Flexible duct connections shall be provided as called for above under Major Equipment and wherever shown on the drawings.

F. Seismic Restraint of Electrical Services:

1. All electrical conduit 2-1/2" in diameter and larger shall be restrained with specification type 12 seismic cable restraints or specification type 13 for seismic solid brace restraints.
2. All electrical bus ducts, cable trays and ladder trays shall be restrained with specification type 12, seismic cable restraints or specification 13 seismic solid brace restraints.
3. Transverse restraints shall occur at 30' intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
4. Longitudinal restraints shall occur at 60' intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' of the intersection of the electric run and if the restraints are sized for the larger electric run.
5. All rigid floor mounted equipment must have a resilient media between the equipment mounting hole and the anchor bolt. Neoprene bushings shall be specification type 4 and anchor bolts shall be specification type 18 or 19.
6. Wall mounted panels shall be mounted with specification type 3 bushings. Floor mounted panels shall be mounted on specification type 4 bushings. Anchor bolts shall be specification type 18 or 19.

G. All fire protection piping shall be braced in accordance with NFPA 13 and 14.

H. All mechanical equipment shall be vibration isolated and seismically restrained.

1. All fire protection equipment is considered life safety equipment and shall be seismically restrained.

3.3 SEISMIC RESTRAINT EXCLUSIONS

A. Piping:

1. All piping less than 2 1/2" except for gas and fire protection piping.
2. All piping in boiler and mechanical equipment rooms less than 1 1/4" I.D.
3. All clevis or trapeze supported piping suspended from hanger rods where the point of attachment is less than the 12" in length from the structure to the structural connection of the clevis or trapeze.
 - a. All PVC and fiberglass suspended waste or vent pipe 6" in diameter and smaller.

B. Ductwork:

1. Rectangular, square or oval ducts less than 6 sq.ft. in cross sectional area.
2. Round duct less than 28" in diameter.
3. Duct supported by hanger rods where the point of attachment is less than 12" in length from the structure to the structural connection of the duct work.

C. Electrical:

1. All conduit less than 2 1/2" diameter suspended by individual hanger rods.

2. All clevis or trapeze supported conduits suspended by hanger rods where the point of attachment is less than 1 2" in length from the structure to the structural connection of the clevis or trapeze.

3.4 INSTALLATION OF VIBRATION ISOLATION EQUIPMENT

A. General

1. Locations of all vibration isolation devices shall be selected for ease of inspection and adjustment as well as for proper operation.
2. Installation of vibration isolation equipment shall be in accordance with the manufacturer's instructions.

B. Isolators

1. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment.
2. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
3. Locate isolators to provide stable support for equipment, without excess rocking.
4. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators. If necessary, a base with suitable footprint shall be provided to maintain stability of supported equipment, whether or not such a base is specifically called for herein.
5. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plates shall rest entirely on the pad.
6. Hanger rods for vibration-isolated support shall be connected to major structural members, not the floor slab between major structural members. Provide suitable intermediate support members as necessary.
7. Vibration isolation hanger elements shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
8. Parallel running pipes may be hung together on a trapeze that is isolated from the building. Isolator deflections must be the greatest required by the provisions for pipe isolation for any single pipe on the trapeze. Do not mix isolated and unisolated pipes on the same trapeze.
 - a. Pipes, ducts and equipment shall not be supported from other pipes, ducts and equipment.
 - b. Resiliently isolated pipes, ducts and equipment shall not come in rigid contact with the building construction or rigidly supported equipment.
 - c. The installed and operating heights of equipment supported by Type FSNTL isolators or with Type RC-2 isolation bases shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide 1/4" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.

- d. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

C. Bases

1. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
2. Unless otherwise indicated, there is to be a minimum operating clearance of 1" between steel rails, steel frame bases or inertia bases and the floor beneath the equipment. The isolator mounting brackets shall be positioned and the isolators adjusted so that the required clearance is maintained. The clearance space shall be checked by the Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
3. Isolation bases shall be installed in strict accordance with the manufacturer's instructions.

D. Flexible Duct Connections:

1. Prior to installation of the flexible connection, sheet metal ducts and plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section, and the gap between connected parts shall be uniform. Flexible duct connections shall not be installed until this provision is met. There shall be no metal-to-metal contact between connected sections, and the fabric shall not be stretched taut.

E. Flexible Pipe Connections:

1. Install flexible pipe connections in strict accordance with the manufacturer's instructions.

F. Thrust Restraints:

1. Thrust restraints shall be attached on each side of the fan parallel to the thrust force. This may require custom brackets or standoffs. The body of the thrust restraint shall not come in contact with the connected elements. Thrust restraints shall be adjusted to constrain equipment movement to the specified limit.

G. Grommets:

1. Where grommets are required at hold down bolts of isolators, bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly over the grommets. Bolts and washers shall be galvanized.

H. Resilient Penetration Sleeve/Seals:

1. Maintain an airtight seal around the penetrating element and prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.

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Section 23 08 00

COMMISSIONING OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this section.
- B. The OPR and BOD documentation are included by reference for information only.

1.2 SUMMARY

- A. This section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

1.3 DESCRIPTION

- A. Refer to Division 01 Section "General Commissioning Requirements" for the description of commissioning.

1.4 DEFINITIONS

- A. Refer to Division 01 Section "General Commissioning Requirements" for definitions.

1.5 SUBMITTALS

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's role.
- B. Refer to Division 01 Section "Submittals" for specific requirements. In addition, provide the following:
- C. Certificates of readiness
- D. Certificates of completion of installation, prestart, and startup activities.
- E. O&M manuals
- F. Test reports

1.6 QUALITY ASSURANCE

- A. Test Equipment Calibration Requirements: Contractors will comply with test manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately after instruments have been repaired resulting from being dropped or damaged. Affix calibration tags to test instruments. Furnish calibration records to CxA upon request.

1.7 COORDINATION

- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to coordination during the commissioning process.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup, initial checkout and functional performance testing shall be provided by the Contractor for the equipment being tested. For example, the mechanical contractor of Division 23 shall ultimately be responsible for all standard testing equipment for the HVAC&R system and controls system in Division 23, except for equipment specific to and used by TAB in their commissioning responsibilities.
- B. Special equipment, tools and instruments (specific to a piece of equipment and only available from vendor) required for testing shall be included in the base bid price to the Owner and left on site, except for stand-alone data logging equipment that may be used by the CxA.
- C. Proprietary test equipment and software required by any equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the commissioning process.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.

PART 3 - EXECUTION

3.1 GENERAL DOCUMENTATION REQUIREMENTS

- A. With assistance from the installing contractors, the CxA will prepare Pre-Functional Checklists for all commissioned components, equipment, and systems
- B. Red-lined Drawings: The contractor will verify all equipment, systems, instrumentation, wiring and components are shown correctly on red-lined drawings. Preliminary red-lined drawings must be made available to the Commissioning Team for use prior to the start of Functional Performance Testing. Changes, as a result of Functional Testing, must be incorporated into the final as-built drawings, which will be created from the red-lined drawings. The contracted party, as defined in the Contract Documents will create the as-built drawings.
- C. Operation and Maintenance Data: Contractor will provide a copy of O&M literature within 45 days of each submittal acceptance for use during the commissioning process for all commissioned equipment and systems. The CxA will review the O&M literature once for conformance to project requirements. The CxA will receive a copy of the final approved O&M literature once corrections have been made by the Contractor.
- D. Demonstration and Training: Contractor will provide demonstration and training as required by the specifications. A complete training plan and schedule must be submitted by the contractor to the CxA four weeks (4) prior to any training. A training agenda for each training session must be submitted to the CxA one (1) week prior to the training session

3.2 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning functional test procedures at the direction of the CxA. This includes but is not limited to the controls contractor verifying with the CxA that all sequences of operations are functioning properly.
- B. Attend construction phase controls coordination meetings.
- C. Attend testing, adjusting, and balancing review and coordination meetings.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. Provide information requested by the CxA for final commissioning documentation. This may include but is not limited to pipe pressure tests, duct leakage tests and flushing / cleaning reports.
- F. Include requirements for submittal data, operation and maintenance data, and training in each purchase order or sub-contract written.
- G. Prepare preliminary schedule for Mechanical system orientations and inspections, operation and maintenance manual submissions, training sessions, pipe and duct system

testing, flushing and cleaning, equipment start-up, testing and balancing and task completion for owner. Distribute preliminary schedule to commissioning team members.

- H. Update schedule as required throughout the construction period.
- I. Assist the CxA in all verification and functional performance tests. While the CxA is onsite the contractor does not need to be with the CxA throughout the entire day but only needs to be available if assistance is needed (such as turning a piece of equipment on). The exception is that the controls contractor is expected to verify all sequences of operation with the CxA.
- J. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- K. Gather operation and maintenance literature on all equipment, and assemble in binders as required by the specifications. Submit to CxA 45 days after submittal acceptance.
- L. Coordinate with the CxA to provide 48-hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
- M. Notify the CxA a minimum of two weeks in advance of the time for start of the testing and balancing work. Attend the initial testing and balancing meeting for review of the official testing and balancing procedures.
- N. Participate in, and schedule vendors and contractors to participate in the training sessions.
- O. Provide written notification to the CM/GC and CxA Authority that the following work has been completed in accordance with the contract documents, and that the equipment, systems, and sub-system are operating as required.
- P. The equipment supplier shall document the performance of his equipment.
- Q. Provide a complete set of red-lined drawings to the CxA prior to the start of Functional Performance Testing.
- R. Test, Adjust and Balance Contractor
 1. Attend initial commissioning coordination meeting scheduled by the Commissioning Authority.
 2. Submit the site specific testing and balancing plan to the CxA and AE for review and acceptance.
 3. Attend the testing and balancing review meeting scheduled by the CxA. Be prepared to discuss the procedures that shall be followed in testing, adjusting, and balancing the HVAC&R system.
 4. At the completion of the testing and balancing work, and the submittal of the final testing and balancing report, notify the HVAC&R contractor and the CM/GC.
 5. At the completion of testing and balancing work, and the submittal of the final testing and balancing report, notify the HVAC&R Contractor and the CM/GC.

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- 6. Participate in verification of the testing and balancing report, which will consist of repeating measurements contained in the testing and balancing reports. Assist in diagnostic purposes when directed.

 - S. Equipment Suppliers
 - 1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner, to keep warranties in force.
 - 2. Assist in equipment testing per agreements with contractors.
 - 3. Provide information requested by CxA regarding equipment sequence of operation and testing procedures.

 - T. Refer to Division 01 Section "General Commissioning Requirements" for additional contractor responsibilities.

3.3 CxA'S RESPONSIBILITIES

- A. Refer to Division 01 Section "General Commissioning Requirements" for CxA's Responsibilities.

3.4 TESTING PREPARATION

- A. Certify in writing to the CxA that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

- B. Certify in writing to the CxA that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

- C. Certify in writing that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

- D. Place systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

- E. Inspect and verify the position of each device and interlock identified on checklists.

- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.5 TESTING, ADJUSTING AND BALANCING VERIFICATION

- A. Prior to performance of Testing, Adjusting and Balancing work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least ten (10) days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing subcontractor ten (10) days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.6 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R contractor, testing and balancing Subcontractor, and HVAC&R Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.
- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.

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- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
 - I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
 - J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.7 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

- A. Equipment Testing and Acceptance Procedures: Testing requirements are specified in individual Division 23 sections. Provide submittals, test data, inspector record, and certifications to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections. Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment: Test requirements are specified in Division 23 piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.

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- F. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.
- G. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The following equipment and systems shall be evaluated:

HVAC Systems
Boilers
Chillers
Piping
Heat Exchangers
Pumps and drives
Air handler systems
Roof Top Units
Heating and ventilating units
Induction Units
Displacement terminal units
Unit Ventilators
Cabinet unit heaters
Fan coil units
Unit heaters
Radiant panels
Finned tube radiation
Convectors
Chilled Beams
Exhaust fans
Combustion air units
Split system AC
Make-up air units
Fume hoods
Heat recovery systems
Thermal Solar Systems
Testing, adjusting and balancing spot check
Automated temperature controls and energy management systems
Building Automation and Controls
Interface of these systems with HVAC systems, fire alarm and security systems.

- 3.8 DEFICIENCIES/NON-CONFORMANCE, COST OF RETESTING, FAILURE DUE TO MANUFACTURER DEFECT
- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deficiencies/non-conformance, cost of retesting, or failure due to manufacturer defect.
- 3.9 APPROVAL
- A. Refer to Division 01 Section "General Commissioning Requirements" for approval procedures.
- 3.10 DEFERRED TESTING
- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to deferred testing.
- 3.11 OPERATION AND MAINTENANCE MANUALS
- A. The Operation and Maintenance Manuals shall conform to Contract Documents requirements as stated in Division 01.
- B. Refer to Division 01 Section "General Commissioning Requirements" for the AE and CxA roles in the Operation and Maintenance Manual contribution, review and approval process.
- 3.12 TRAINING OF OWNER PERSONNEL
- A. Refer to Division 01 Section "General Commissioning Requirements" for requirements pertaining to training.

End of Section

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