Glendale Unified School District

Clark Magnet High School
Engineering Technology Center

4747 New York Avenue, Glendale, CA 91214

TECHNICAL SPECIFICATIONS

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-120696 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 09/17/2020

NAC Architecture

Architect's Job No.
161-19034

September 4, 2020

Architect
NAC Architecture
837 North Spring Street, 3rd Floor
Los Angeles, CA 90012

Structural Engineer
KPFF
700 South Flower Street, Suite 2100
Los Angeles, CA 90017

Civil Engineer
Brandow & Johnston
700 South Flower Street, Suite 1800
Los Angeles, California 90017

Mechanical, Electrical, Plumbing, Fire Protection
Henderson Engineers
510 West 6th Street #800
Los Angeles, CA 90014

SECTION 00 01 10

TABLE OF CONTENTS

END OF TABLE OF CONTENTS

SECTION 01 10 00

SUMMARY OF THE PROJECT

PART 1 - GENERAL

1.01 WORK OF THE CONTRACTOR:

A. Scope of Work: Contractor shall perform, within the time stipulated, the Contract, including all of its component parts, and everything required to be performed, and to provide and furnish any and all of the labor, materials, tools, expendable equipment, and all applicable taxes, and all utility and transportation services necessary to perform the Contract and complete, in a workmanlike manner, all of the Work required in connection with the following titled Project in strict conformity with the Contract Documents:

CLARK MAGNET HIGH SCHOOL – ENGINEERING TECHNOLOGY CENTER
4747 NEW YORK AVE
Glendale, California

B. This school is on a traditional school year calendar, August through June. During the period of this contract, school events and educational requirements will limit or prevent access, and will affect Contractor work hours for a portion or all of the school building (s) pertinent to the contract. Contractor shall maintain schedule with full knowledge of these times and dates to be determined. A site-specific calendar will include currently known dates of limited access, or times of the school day that noise will have to be limited, or ceased. These shall include during the time of the project, but not be limited to:

1. No work after 6:00 p.m. on six (6) weekday evenings for back-to-school, open house, and other events per school year at each school site.

2. No work between 8:00 a.m. and 10:00 a.m. on five (5) student attendance weekdays for assembly events per school year.

3. NO NOISE/WORK will be allowed on an Elementary school site between 8:00 a.m. and 12:30 p.m. on twelve (12) student attendance weekdays for testing (four (4) consecutive weekdays, three times) per school year. Second shift work may be accommodated with the request pre-approved by the District Project Manager.

4. NO NOISE/WORK will be allowed on a Middle School or High School site between 8:00 a.m. and 1:30 p.m. on twenty (20) student attendance weekdays for testing (four (4) consecutive weekdays during the first semester; sixteen (16) consecutive weekdays during the second semester) per school year. Second shift work may be accommodated with the request pre-approved by the District Project Manager.

C. It shall be noted that there are students in the Early and Extended Education Learning Program in attendance on the Elementary school sites from 6:00 a.m. through 6:00 p.m. on a daily basis throughout the school year, and on each day that Classified Staff are assigned working hours (see specific EEELP calendar for each site, per each school year).

D. Work hours for the Project shall be from 7:00 a.m. until 10:00 p.m. Monday through Saturday, unless advance permission to deviate from these hours is obtained from the City of Glendale per Glendale Municipal Code, Title 8, Chapter 36, and this request is also approved in writing five working days beforehand by the District Project Manager.

E. Article 3 of the Bid General Conditions requires preparation of a Cost-loaded time logic schedule with a single critical path. If the Board approved lowest responsive and responsible

bid Contractor and the Project Manager, on behalf of the District, cannot agree on the contract construction schedule and the project single critical path within fifteen (15) days after Notice to Proceed, the District may terminate the Contract, for convenience, as outlined in the Project General Conditions. In the event this is necessary, compensation to the General Contractor and all subcontractors or materialmen shall be limited to Mobilization costs only.

F. The liquidated damages shown in the Supplementary General Conditions shall apply to each phase of the phased construction plan, as defined by and within the plans and specifications.

G. No warranties or guarantees shall go into effect, for any trade, regardless of when completed in the sequence of the project erection, until one (1) day after the Board of Education has accepted the project at a noticed meeting. Attention: Bidders. This will require certain trades to bid for, and provide, a warranty of longer than one (1) year in length from the time of installation or furnishing of their materials to the project, depending upon the sequencing of their work within the overall schedule.

H. All project close-out/punchlist items, project record documents, submittals, and operations manuals and spare parts, warranties and guarantees and Contractor's Final Verified Report (DSA6) shall be reviewed and accepted prior to the Architect/District agreed upon authorization to file the Notice of Completion with the Los Angeles County Recorder.

I. In the event that any materials requiring DSA Inspection (steel, concrete, masonry grout, etc.) are manufactured in an area located more than one hundred miles (100 miles) by air radius from the project site, all round-trip travel and all per diem costs incurred by the District on behalf of the Deputy Inspector who must perform on-site examination of the materials shall be borne 100% by the Contractor as an added expense. This charge shall be subtracted from the monthly "Application for Payment" submitted to the District on behalf of the project.

J. In the event the General Contractor or any subcontractor or materialman (on or off site) voluntarily accelerates the schedule for their own purposes, and/or voluntarily performs work in excess of eight (8) hours per day, or on the weekends or holidays, the additional cost of the Inspectors' overtime premiums which are required to inspect the work during these hours shall be paid 100% by the Contractor. This charge shall also be subtracted from the monthly "Application for Payment" submitted to the District on behalf of the project.

K. In the event that the Contractor fails to complete all punch list items and turn over all "deliverables, warranties, As-builts, etc." within sixty (60) days after acceptance of completion by the Board of Education, the full salary costs of one (1) construction Project Manager (16 hours per week @ $120.00/hour) and one DSA Project Inspector (actual hours spent @$80.00/hour) shall be backcharged to the Contractor, in addition to the liquidated damages, if any, imposed upon the Contractor for late performance. THIS PARAGRAPH WILL BE STRICTLY ENFORCED.

L. The submission of complete project record documents, as required by the specifications, is critical. A value of Thirty Thousand Dollars ($30,000.00) shall be assigned to these record documents within the Schedule of Values and will not be paid or released until the documents are approved by the Architect and turned over to the District's Administrator of Planning, Development and Facilities.

M. The intent of these contract documents is that the work of alteration, rehabilitation or construction is to be accordance with Title 24, California Code of Regulations. Should any existing conditions such as deterioration or non complying construction be discovered which is not covered by the Contract Documents wherein the finished work will not comply with Title 24, California Code of Regulations, a change order, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.

1.02 RELATED WORK BY DISTRICT:

A. General: All such work indicated in Contract Documents and/or specified herein.

B. Coordination:

1. Contractor shall schedule and coordinate Owner work with his work; give 5 days min. advance notice of all dates; verify that Owner work has been accomplished prior to beginning his work

C. Owner Furnished Items or Products (IF ANY):

1. Owner Responsibilities:

a. Delivery of items or products to site.

b. Schedule delivery date with supplier in accord with Contractor's schedule.

c. Obtain installation drawings and instructions.

d. Submit claims for transportation damages.

e. Arrange guarantees, warranties.

2. Contractor's Responsibilities:

a. Schedule required delivery date for each product, and inform Owner.

b. Promptly inspect delivered products, report damaged or defective items.

c. Unload; handle at site, including uncrating and storage.

d. Protect from exposure to elements, from damage.

e. Repair or replace items damaged as result of Contractor's operations.

f. Install, connect, finish products.

B. The Contractor shall provide adequate storage within his fenced staging area, to store the equipment. The Contractor is solely responsible for the storage of this equipment within his staging area and all subsequent movement of this equipment. The Contractor shall be solely responsible for the maintenance and protection of all material.

C. Bidders submitting under this Contract shall include the price for all necessary coordination with the District and the equipment manufacturer, as required for proper and complete coordination between all trades and all Contractors, within their bid.

1.05 WORK BY OTHERS

A. The District reserves the right to do other work in connection with the project or adjacent thereto by contract or otherwise, and Contractor shall at all times conduct the work so as to impose no hardship on District or others engaged in District’s work nor to cause any unreasonably delay or hindrance thereto.

B. Where two or more Contractors are employed on related or adjacent work, each shall conduct their operation in such a manner as not to cause delay or additional expense to the other.

C. Contractor shall be responsible to others engaged in the related or adjacent work for all damage to work, to persons, or for loss by failure to finish the work within the specified time for completion. Contractor shall coordinate his work with the work of others so that no discrepancies shall result in the project.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Alternates: This Section identifies each Alternate by number, and describes the basic changes to be incorporated into the Work, when the specific Alternate is made a part of the Work.

1. Referenced sections of specifications stipulate pertinent requirements for products and methods to achieve the work stipulated under each alternate.

2. Coordinate pertinent related work and modify surrounding work as required to properly integrate the work under each Alternate, and to provide the complete construction required by Contract Documents.

B. Owner's Option: Incorporation of any Alternate into the Work is at Owner's option.

1.02 DESCRIPTION: BASE BID

A. All of the "In-Contract" work shown on Contract Documents, except for additive Alternates.

B. Contractor's overhead, profit, bond, taxes and required permit fees on above items.

1.03 ALTERNATE LIST: N/A

1.04 CONTRACT CONSIDERATIONS:

A. Indicate prices for each alternate on Bid Form; if no change in price required, indicate no change.

B. Indicate on the bid form the amount to be added or deducted from the base bid, should the alternate be accepted.

C. Include in alternate price all miscellaneous materials, parts, accessories incidental to or required for a complete installation regardless of whether they are mentioned in the alternate description.

D. Voluntary alternates will not be considered in evaluation of bids.

E. The Owner reserves the right to accept any or all alternates in order or combination.

F. The Owner reserves the right to accept no alternates.

G. Accepted alternates will be identified in the Agreement.

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 Alternates

A. Notify in writing each party involved of the status of each alternate, immediately after notification by the Owner's Project Manager.

B. Coordinate alternate work with related work and modify adjacent work as required.

END OF SECTION

SECTION 01 25 00

SUBSTITUTIONS AND PRODUCT OPTIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A PRODUCT LIST:

1. Within ten (10) working days after date of Contract, submit to the Architect five (5) copies of complete lists of all products which are proposed substitutions and those proposed as “or equal:” to products specified, and in accordance with Contract documents.

2. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

3. For products specified by naming several products or manufacturers, select any products and manufacturer named.

1.02 SUBSTITUTIONS

A. Requests for substitutions shall be made only in writing on the “SUBSTITUTIONS REQUEST" form attached with all blanks completed except those reserved for the Design Consultant. <u>All substitution requests shall be made by the Contractor.</u>

B. In connection with the use of any substitute item approved by the Architect it shall be the Contractor’s responsibility to see that such items meet all space requirements, and that any alterations to connecting items necessitated by use of the alternate items are properly made, at no increase in cost to the District.

C. In making request for substitutions, Bidder/Contractor represents that:

1. He has investigated the proposed products or method and determined that it is equal or better in all respects to that specified and that it fully complies with all requirements of the Contract Documents.

2. He will meet all contract obligations with regards to this substitution;

3. He will coordinate installation of accepted substitutions into the work, making all such changes and any required schedule adjustments, at no additional cost to the District, as may be required for the work to be completed in all respects;

4. He waives all claims for additional costs and additional time related to substitutions which consequently become apparent. He also agrees to hold the District and Architect harmless from claims for extra costs and time incurred by other subcontractors and suppliers, or additional services which may have to be performed by the Architect, for changes or extra work that may, at some time or date, be determined to be necessary in order for the work to function in the manner intended in the Contract Documents.

5. He shall provide the same warranty and guarantee, and perform any work required in accordance therewith, for the substitution that is applicable to the specified item for which the substitution is requested;

6. Material shall be installed, handled, store, adjusted, tested, and operated in accordance with the manufacturer's recommendation and as specified in the Contract Documents.

7. In all cases, new materials shall be used unless this provision is waived by written notice from the Architect or unless otherwise specified in the Contract Documents; and

8. All material and workmanship shall in every respect be in accordance with and in conformity with approved modern and accepted industry practices, and shall conform to all applicable codes, regulations, laws, ordinances, and Contract Documents.

1.03 DESIGN PROFESSIONAL OPTIONS

A. The Architect will be sole judge of acceptability of any proposed substitutions, and only approved substitutions that are accepted in writing may be used on contract work.

B. Each request for substitution approval shall include:

1. "Substitution Request" form with all required data completed, and accompanying specifications, etc., in triplicate.

2. Identity of product for which substitution is requested; include specifications page and paragraph number.

3. Identity of substitution; include complete product description, drawings, photographs, performance and test data, and any other information necessary for evaluation.

4. Quality and technical specification comparison of proposed substitution with specified products.

5. A description of changes required in other work because of substitution.

6. Effect on construction progress schedule.

7. Cost comparison of proposed substitution with specified product.

8. Any required license fees or royalties.

9. Availability of local maintenance service within a 50 mile air radius of the project.

10. Source of replacement material or spare parts; if necessary, within a 50 mile air radius of the project.

1.04 SUBSTITUTION REQUESTS DURING BIDDING PERIOD

No request for substitution approval will be considered unless written request in triplicate has been submitted on the "Substitution Request" form included herein and has been received by the Architect at least ten (10) working days prior to bid opening date. The Architect will issue addenda prior to bid opening listing all <u>approved</u> substitutions, should there be any approved.

1.05 SUBSTITUTION REQUESTS AFTER CONTRACT AWARD

A. Approval will be granted <u>only</u> when:

1. Specified product cannot be delivered without project delay, or

2. Specified product has been discontinued, or,

3. Specified product has been replaced by superior product, or

4. Specified product cannot be guaranteed as specified, or

5. Specified product will not fit within designated space, or

6. Substitution otherwise determined by the District to be in its best interest.

B. The Contractor's request for substitution shall be accompanied by evidence documenting the reason for the substitution falls within one or more of the cases listed in A1 through A6 above.

C. A Change Order authorizing substitutions and revising Contract Sum where appropriate will be issued for approved substitutions.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SUBSTITUTION REQUEST (in triplicate)

TO: _____

PROJECT: _____

SPECIFIED ITEM:

_____

SECTION PAGE PARAGRAPH DESCRIPTION

The undersigned requests consideration for the following:

PROPOSED SUBSTITUTION: _____

STATE THE REASON(S) FOR PROPOSED SUBSTITUTION: (REASON MUST CONFORM TO ONE OR MORE CASES LISTED IN PARAGRAPH 1.05 A1 THROUGH 1.0A6.)

_____

_____

_____

Attached data includes product description, specifications, drawings, photographs, performance and test data adequate for evaluation of the request and applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents which the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitution does not affect dimensions shown on drawings:
2 The undersigned will pay for changes to the building design, including Architect's and engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other trades, the construction schedule or specified warranty requirements.
4. Maintenance and service parts will be locally available (<50 miles from project) for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item.

Submitted by:

Signature: _____

Firm: _____

Address: _____

_____

Date: _____

Telephone: _____

For use by the Architect:

☐ Accepted ☐ Accepted as noted

☐ Not Accepted ☐ Received too late

By: _____

Date: _____

Remarks: _____

_____

Attachments: _____

SECTION 01 25 01

REQUEST FOR INFORMATION (RFI)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedure for requesting clarification of the intent of the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01 10 00: Summary of Work

B. Section 01 32 00: Schedules and Reports

C. Section 01 77 00: Project Closeout

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 PROCEDURE

A. Prime Contractor shall prepare a Request for Information on the form provided and approved by the Architect and District. Prior to the submission of any RFI Prime Contractor is responsible for thoroughly reviewing all contract documents to insure that the answer to the question is not contained therein. Prime Contractor shall transmit the Request for Information to the Architect with any supporting information.

B. Prime Contractor shall maintain a log of all RFI's that he submits to the Architect on a weekly basis at the weekly project meetings. RFI's shall be identified with a sequential number and be dated. Reference your company's name and the name of the subcontractor asking the question, if applicable, as well as the scope of work.

C. RFI question and location shall be specific and clear. Indicate reference to construction documents sheet and detail number, as well as specification section.

D. ARCHITECT response is a clarification of the intent of the Contract Documents and does not authorize changes in the Contract Amount, Milestones and/or Contract Time.

E. A Request for Information may be returned with a stamp or notation "Not Reviewed", if, in the opinion of ARCHITECT:

1. The requested clarification is ambiguous or unclear to ARCHITECT

2. The requested clarification is equally available to the requesting party by researching and/or examining the Contract Documents

3. Prime Contractor has not reviewed the Request for Information prior to submittal to Architect.

F. Allow a minimum of seven (7) calendar days for review and response time, after receipt by ARCHITECT. Architect will forward response to Contractor and Project Manager and DSA Inspector.

END OF SECTION

SECTION 01 31 00

PROJECT COORDINATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Coordination of Work of Contract.

1.02 RELATED REQUIREMENTS

A. General Conditions

B. Section 01 73 29 — Cutting and Patching

D. Section 01 31 50 — Project Meetings

E. Section 01 25 00 — Substitutions and Product Options

F. Section 01 77 00 — Project Closeout

1.03 SUBMITTALS

A. Coordination Drawings: Submit as specified herein.

B. Work Plans: Submit as specified herein.

1.04 DESCRIPTION

A. Coordinate scheduling, work activities, submittals, including deferred approvals, District separate contracts and work of the various sections of Specifications in accordance with the Master Project Schedule.

B. Coordinate sequence of Work to accommodate District’s separate contract and District’s Occupancy as specified.

C. Set up control procedures so that the Master Project Schedule is adhered. Contractor's responsibility is to properly notify District’s Project Manager of anticipated and actual time delays. Refer to General Conditions.

D. Coordinate the Work and do not delegate responsibility for coordination to any Subcontractor.

E. Anticipate the interrelationship of all Subcontractors, District separate contracts, and their relationship with the Work

F. Resolve differences or disputes between Subcontractors concerning coordination, OR interference of Work between SECTIONS.

1.05 NOT USED

1.06 NOT USED

1.07 COORDINATION

A. General: Work of the Contract includes coordination of the entire work of the Project, from beginning of construction activity through Project close-out and warranty periods.

B. Mechanical/Electrical Requirements of General Work: Comply with applicable requirements of Division 15 Sections for Mechanical Provisions within units of General Work and comply with applicable requirements of Division 16 for Electrical provisions within units of General Work.

C. Service Connections: Except as otherwise indicated, final connection of mechanical services to general work is defined as being mechanical work and final connection of electrical services to general work is defined as electrical work.

D. Coordination: The Project will require close cooperation and coordination with the school site administration, the Architectural team, District Project Manager, and Contractor and Subcontractors. The Contractor shall consider all such coordination in his work inclusive, but not limited to, scheduling and proper sequencing of the Work with subcontractors and the District school site calendar and times that work cannot be, or occupied areas of the project school site that cannot be undertaken, during the entire project. In particular, the coordination of work before District's substantial completion of each project phase, and ensuring the site administration, the Architectural team, Inspector, and District Project Manager are fully advised of his activities to complete the Work in accordance with the Master Project Schedule.

E. Coordination/Engineering Drawings:

1. Contractor shall prepare and submit complete 1/4 " = 1'0" coordination drawings, Including plans, sections, details, etc., indicating the complete layout and all mechanical and electrical materials and equipment in all areas and within the ceiling spaces for new and existing conditions, including bottom of duct, pipe, conduit and elevations to allow District Architectural team to review with other Prime Trade Contractors' work that Contractor ensures will be coordinated properly.

2. Mechanical, plumbing and electrical Prime Trade Contractors shall be responsible for providing all vertical sections through floors showing structural physical restraints, architectural restraints, plenum spaces and all other physical obstructions that may affect work.

3. Electronic reproduction or photo reproduction of the project's Architectural, Structural, or MEP drawings will not be acceptable.

G. Mechanical, plumbing and electrical Prime Trade Contractors shall prepare a 1/4" sleeving layout indicating size and location of sleeves. Provide copies to applicable trades and District Architectural team.

H. Coordination/Engineering Drawings: These drawings are for the Contractor's and District’s Representative's use during construction and shall not be construed as replacing any shop drawings, "as-built", or Record Drawings required elsewhere in these Contract Documents.

I. Debris Removal and Material Access: An area will be designated for debris removal and material access as agreed by the Contractor and Architectural team at the school site.

1.08 EQUIPMENT COORDINATION

A. Equipment Coordination: With respect to mechanical and electrical features of Contractor and/or District supplied equipment, complete data must be exchanged directly between the Contractor and those vendors and subcontractors involved as the progress of the Project

requires. The person requesting the information shall advise when it will be required.

B. The Prime Trade Contractor's for casework and equipment are expressly required to provide large scale layout drawings for casework and equipment showing the required rough-in locations of all services (dimensioned from building features) service characteristics, and locations of studs where the location is critical to mounting or otherwise installing equipment and casework. Furnish sizes and spacing required for Mechanical and Electrical cutouts, and a complete brochure of fittings, sinks, outlets, or other information to provide complete data on the items and accessories being furnished.

C. In the event of incorrect, incomplete, delayed or improperly identified information, the entity causing the delay or error shall be responsible and pay for any modifications or replacements necessary to provide a correct, proper and new installation, including relocations required.

1.09 MEETINGS

A. In addition to progress meetings specified in Section 01 31 50, attend coordination meetings and pre-installation conferences with requisite personnel to assure coordination of Work when scheduled with the Architectural, Engineer, Inspector, or Project Manager.

1.10 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals as required and as specified in Section 01 33 00.

B. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such materials and equipment.

C. Coordinate requests for substitutions to assure compatibility of space, of operating elements, and effect on work of other sections.

D. Prime Trade Contractors shall submit the following drawings for review and approval:

1. Fire Protection Drawings.

2. Fire Alarm System.

1.11 COORDINATION OF SPACE

A. Mechanical, plumbing and electrical Prime Trade Contractors shall coordinate use of Project space and sequence of installation of mechanical, and electrical work which is indicated diagrammatically on Drawings. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

B. In finished areas, except as otherwise shown, conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

C. Off-Site Fabrication: Off-site fabrication is encouraged as much as possible and deliveries scheduled so materials and equipment can be installed immediately after delivery. The Contractors shall alert and advise materialmen of the need to hold deliveries until they are notified the materials are required on the site.

1.12 ELECTRICAL COORDINATION

A. Provide supervision, communications, and coordination necessary to meet the requirements of electrical power connection as set forth by the designated power company (e.g. Glendale Water and Power; SoCal Edison).

B. Provide reasonable and convenient staging and access areas near buildings to permit the respective Utility or its vendors or subcontractors, to install, modify or remove equipment and other components of the electrical power system furnished and installed by the designated power company.

1.13 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation of District school site occupancy with approval of final cleanup by the Inspector and Project Manager.

B. After District occupancy of premises, coordinate access to site by various sections for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of District/school activities.

C. Assemble and coordinate closeout submittals specified in Section 01 33 00.

1.14 NOT USED

1.15 PROTECTION OF EXISTING STRUCTURES AND UTILITIES

A. The Drawings show, if applicable, existing above and below grade structures, drainage lines, storm drains, sewers, water, gas, electrical, hot water, and other utilities which are known to the District.

B. Locate all known existing installations before proceeding with construction operations which may cause damage to such installations. Existing installations shall be kept in service where possible and damage to them shall be repaired with no adjustment of Contract Sum. District archives as-built drawings, and Contractor shall be responsible to request to view any and all drawings for the areas that may be affected in the construction before the work begins.

C. If any unforeseen structures or utilities are encountered, request District's Architectural Team to provide direction on how to proceed with the Work.

D. If any structure or utility is damaged, take appropriate action to ensure the safety of persons and property and report the same to the District's Architectural Team, and begin immediate remediation of any safety-related condition.

PART 2 — PRODUCTS - NOT USED.

PART 3 — EXECUTION - NOT USED

SECTION 01 31 50

PROJECT MEETINGS

PART 1-GENERAL

1.01 SUMMARY

A. Work Included in this Section:

1. The Contractor's participation in preconstruction conference, application for payment, and guarantees, bonds, service and maintenance contracts review meetings.

2. The Contractor's administration and participation in project weekly progress meetings, pre-installation conferences and other meetings, as necessary.

1.02 PRE-CONSTRUCTION CONFERENCE

A. Prior to commencement of Work, attend a pre-construction conference at time and a place selected by the School District to discuss procedures to be followed during the course of the work.

B. The purpose of the conference is to introduce the Clark Magnet High School Project with the Architectural Team, the Inspector, the Construction/Project Managers, and the School's Representative key personnel, to review the contract provisions, project procedures, and other items pertaining to the Project; distribute documents including sample forms referenced in the Contract Documents; answer any questions related to construction contract administration; and establish schedule and procedures for future meetings. (This meeting is NOT to discuss any construction related specific specifications and drawings, nor address any requests for substitutions, etc.)

C. Attending shall be:

1. District Representatives from Planning, Development and Facilities, Facility and Support Operations, and/or the Business Office.

2. School Site Representatives, including the Construction Liaison

3. The Project Inspector

4. The Architect of Record, and Architect's Construction Architect

5. The Engineering Consultants

6. The Contractor's Contracts Representative/Project Manager

7. The Contractor's on Site Representative/Superintendent

8. Representatives of the major subcontractors, as necessary

1.03 CONSTRUCTION PROGRESS MEETINGS

A. During the course of construction, progress meetings will be held to discuss and resolve field problems.

B. Meeting Schedule: At maximum one-week intervals or more often when required by the Architect/Inspector and/or Project Manager.

C. Meeting Location: As designated by the District's Project Manager, in conjunction with the School Site liaison.

D. Attending shall be:

1. The District's Representative from Planning, Development and Facilities, Facility and Support Operations, and/or the Business Office

2. The Project Inspector

3. The Architect's Construction Architect

4. The Engineering Consultants as appropriate to the Meeting Minute format, and as agreed upon by the Contractor and the Project Manager beforehand

5. The Contractor's On-Site Superintendent

6. The Contractor's Representative/Project Manager

7. Representatives of subcontractors/major suppliers as appropriate to a specific item of the Meeting Minute format, and at the time the specific item is reflected on the Meeting Minutes.

8. Others as appropriate to the Meeting Minute format and as agreed upon by the Contractor and the Project Manager beforehand.

NOTE: Representatives of the Contractor, subcontractors and suppliers attending Construction Progress Meetings shall be qualified and authorized to act on behalf of the entity each represents.

F. Suggested Agenda:

1. Review and approve minutes of previous meeting.

2. Review of work progress since previous meeting.

3. Review of upcoming work to take place in project schedule.

4. Discuss School Site concerns with regard to safety, paths of travel, and any upcoming events that may affect the work schedule.

5. Discuss field observations, problems, and decisions, affecting the work.

6. Review submittals schedule and status of submittals.

7. Review status of proposed substitutions, if any.

8. Review off-site fabrication and delivery schedules.

9. Review maintenance of progress schedule.

10. Agree on corrective measures to regain projected schedules, as necessary.

11. Review planned progress during succeeding work period.

12. Review coordination of projected progress.

13. Review maintenance of quality and work standards.

14. Review project safety of workers and practices.

15. Review any Inspector of Record Field Notices, or Deviations logs.

16. Other items relating to the Work.

G. The Architect, in coordination with the Project Manager, will make physical arrangements for project meetings, and the Architect shall prepare agenda, preside at meetings, record minutes, and distribute electronic draft copies of Minutes within three working days after Construction Project Meetings to the Project Manager, Inspector, conference participants and those affected by the decisions made at the conference. The Architect will record in the Minutes significant discussions and agreements and disagreements.

1.04 PRE-INSTALLATION CONFERENCES

A. The Architect/Inspector may conduct a pre-installation conference at the site before each construction activity that the Architect/Inspector deems requires coordination with other construction or when required by the Construction documents.

B. Attendance will be required of parties directly affecting, or affected by, or involved in the installation, and its coordination or integration with other materials and installations that have preceded or will follow the particular item of work or activity under consideration. Parties attending the conference shall be qualified and authorized to act on behalf of entity each represents.

C. Conference Schedule: Schedule conference to assure a sufficient amount of time prior to the scheduled work or activity under consideration so that any concerns, problems or disagreements can be resolved without delaying the Project.

D. The Architect, on conjunction with the Inspector, will make physical arrangements for conferences, prepare the agenda, preside at conferences, record minutes, and distribute copies within two working days after a conference to the Project Manager, Inspector, conference participants and those affected by the decisions made at the conference. The Architect will record in the progress meeting minutes significant discussions and agreements and disagreements as takes place in pre-installation conferences.

E. Suggested Agenda: Review the progress of other construction activities and preparations for the particular activity under consideration, including requirements for:

1. Contract Documents

2. Options

3. Related Change Orders

4. Purchases

5. Deliveries

6. Shop Drawings, Product Data and quality control Samples

7. Possible conflicts

8. Compatibility problems

9. Time Schedules

10. Weather limitations

11. Manufacturer's recommendations

12. Compatibility of materials

13. Acceptability of substrates

14. Temporary facilities

15. Space and access limitations

16. Governing regulations

17. Safety

18. Inspection and testing requirements

19. Required performance results

20. Recording requirements

21. Protection

F. Do not proceed with the work or activity if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of work and reconvene the conference at the earliest feasible date.

1.05 OTHER REQUIRED MEETINGS

A. Project Closeout Meeting:

1. Thirty (30) days prior to the estimated substantial completion the project/phase, the Architect, Inspector, and Project will coordinate a meeting to review required construction maintenance manuals, guarantees, closeout submittals, bonds, and service contracts for materials and equipment; review and implement repair and replacement of defective items, and extend service and maintenance contracts, and schedule site training for all equipment.

2. Attending shall be:

a. The District's Representative of Planning, Development and Facilities, Facility and Support Operations, and/or Business Office

b. The Project Inspector

c. The Construction/Project Manager

d. The Engineering Consultants, as appropriate

e. The Contractor's on-site Superintendent

f. Subcontractors, as appropriate

g. Suppliers, as appropriate

h. Others, as appropriate

B. Guarantees, Bonds, and Service and Maintenance Review Meeting:

1. Eleven months following the date of Substantial Completion, the District Project Manager will convene a meeting for the purpose of reviewing the guarantees, bonds, and service and maintenance contracts for materials and equipment.

2. Attending shall be:

a. The District's Representative

b. The Architect

c. The Engineering Consultants, as appropriate

d. The Contractor's Representative

e. Subcontractors and Suppliers, only as appropriate

f. Others as appropriate

1.06 PRIME TRADE CONTRACTOR MEETINGS

A. Construction Progress Meetings:

1. To be held at maximum one-week intervals or more often when required by the Architect/Inspector/Construction Project Manager.

2. Meeting Location: Contractor Jobsite trailer

3. All Prime Trade Contractors shall attend in order to review progress of work and submit any questions or requests to the Contractor in order to ensure coordination of installations during the work schedule.

END OF SECTION

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SECTION 01 32 00

SCHEDULES AND REPORTS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Coordinate both the listing and timing of reports and other activities required by provisions of this and other Sections, to provide consistency and logical coordination between the reports. Maintain coordination and correlation between separate reports by updating at monthly or shorter time intervals. Make monthly distribution of the progress schedule and update to all parties involved in the work including the Architect, Inspector, and Project Manager, along with the Request/Application for Payment. Provide definition and coordination of the progress schedule, with phases, changes, schedule of values, funding sources and progress reports.

B. CPM Schedule: Secure critical time commitments for performing major elements of the work of no longer than 60-day increments. Within 30 days after the Notice to Proceed, submit a comprehensive CPM chart progress schedule indicating, by stage-coded symbols, milestones for each major specification section, category, or unit of work to be performed; include minor elements of work, which are, nevertheless, involved in overall sequencing of the work. Include dates for completion of each phase of work. Arrange schedule to show graphically the major sequences of work necessary for the completion of related elements of work. Arrange the schedule to allow for the Architect's review of submittals as well as procedure for certification of substantial completion. Prepare and maintain the schedule on a sheet of sufficient width (or a series of sheets) to show the required data clearly for the entire construction time. Prepare the schedule on sheets of stable transparency, or other reproducible material, to permit reproduction for the required distribution.

C. Daily Reports: Prepare a daily report, recording the following information concerning events at the site; make available to the Inspector for on-site review and submit duplicate copies to the Inspector and Architect upon request:

1. List of Contractor personnel at the site
2. List of Subcontractors at the site
3. Accurate Count of personnel at the site by trade, and Subcontractor
4. Material and Equipment Deliveries
5. High/low temperatures, and general weather conditions.
6. Accidents or injuries.
7. Meetings and significant decisions.
8. Unusual events.
9. Stoppages, delays, shortages, losses.
10. Emergency procedures, field orders.
11. Orders/requests by governing authorities, signed.
12. Services connected, disconnected.
13. Equipment or system tests and start-ups.
14. Partial completions, occupancies.
15. Substantial completion requested.
16. Substantial completion authorized.
17. Requests for Inspections

D. Progress Reports: Contractor shall submit "Verified Reports", on prescribed form, of construction per requirements of Title 24, CCR.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Procedures for submitting to the Architect, shop drawings, product data, samples, and material lists required by specification section and procedures for submitting hardware lists to the District.

1.02 RELATED SECTIONS:

A. Section 01 32 00: Schedules and Reports.

B. Submittal of guarantees, warranties, certificates, operation and maintenance manuals and as-built drawings: Section 01 77 00, Project Close-Out.

C. Submittals: See Respective Specification Sections.

1.03 PROCEDURES:

A. At the start of the project the Contractor shall review the documentation required for Project Completion. This shall include documentation requested by the Architect: Shop drawings, manufacturer's catalogs, samples, warranties, operation and instruction manuals.

B. The Contractor shall, during the course of the project, secure, review and approve, and submit the required documentation to the Architect for review and approval.

C. After the Architect has date-stamped, signed and reviewed the submittals, with corrections noted if any, the Architect will transmit submittals to Contractor and if not rejected, to the District Inspector.

1.04 CONTRACT:

A. Furnish simultaneously the following number of executed copies of:

1. Agreement: Five (5).

2. Performance Bond: Five (5).

3. Payment Bond: Five (5).

4. Certificate - Workmen's Compensation: Six (6).

5. Certificates showing "Proof of Carriage of Insurance" required by General Conditions: Six (6).

6. Non-Collusion Affidavit: Six (6).

1.05 SUBMITTALS; GENERAL:

A. Deliver all submittals to the Architect. Identify project name and address, telephone number of Contractor, subcontractor and supplier. Identify, as appropriate, the pertinent drawing sheets, detail numbers and Specification Section numbers. Clearly identify any deviations from

contract documents. Number submittals using the appropriate specification section, and a hyphen, then the number of the submittal, in sequence.

B. Make submittals in accordance with approved Construction Schedule in sequence that avoids delaying work and the progress of other Contractors.

C. Contractor shall thoroughly review; make coordination corrections, date and sign submittals prior to transmitting to Architect, specifically noting relative deviations from the Contract Documents.

D. Timing of Submittals:

1. Contractor shall submit required submittals in a timely manner, according to the construction schedule, allowing time for the Architect and related MEP or Structural Engineer's, or DSA Inspector's review, for the project and/or each respective Phase of Construction.

2. Contractor shall submit ALL required submittals for the project/phase not less than thirty-five (35) calendar days before the product/material is required for inclusion in the construction of the project beginning with the District's Notice to Proceed. Failure to meet the 35 day requirement shall result in a $160.00 per calendar day for each submittal not submitted in order to compensate for any necessary expedited review by A&E/Inspector. Submittals shall be complete and shall meet the requirements of the Contract Documents or they shall be considered invalid and the penalty shall apply. The contractor shall submit submittals earlier than the 35 day requirement if the project schedule requires. The contractor shall allow for the Architect's contract review time in order to return the Submittal to the contractor. The Submittals shall be related to the work progress and shall be so organized as to allow sufficient time for mailing, reviewing, corrections, resubmission and re-reviewing.

3. The Contractor shall coordinate the submittal of related items with their respective sub contractors.

3. In scheduling, allow at least ten (10) full working days for Architect's review following receipt of the submittal. For Mechanical, Plumbing, Electrical, Structural and other submittals that require joint review, allow a minimum of fifteen (15) full working days following receipt of submittal.

E. Each submittal shall be accompanied by a letter of transmittal containing a complete itemized and numbered list of the submitted materials. Separate letters of transmittal shall accompany each submittal from different specification sections.

F. Resubmission: If requested, resubmit submittals in a timely manner. Resubmit as specified for initial submittal but identify as such with a sequential alphabetical character. Indicate any changes that have been made other than those requested by Architect.

1.06 SUBSTITUTIONS:

A. Contractor shall provide specified manufacturer's products unless:

1. Specified product cannot be delivered without project delay, or.

2. Specified product has been discontinued, or,

3. Specified product has been replaced by superior product, or

4. Specified product cannot be guaranteed as specified, or

5. Specified product will not fit within designated space, or

6. Substitution otherwise determined by the District to be in its best interest.

B. Contractor shall submit request for substitutions in accordance with the General Conditions.

1.07 SHOP DRAWINGS:

A. Shop Drawings are original drawings prepared by the Contractor, subcontractor, supplier, or distributor, which illustrate some portion of the work by showing fabrication, layout, setting, or erection details. Reproductions in whole or in part of the contract drawings shall not be part of the shop drawings.

B. Make shop drawings accurately to scale and sufficiently large to show all pertinent assembly features and methods of connection.

C. Copies Required and Distribution: Unless otherwise indicated, submit six (6) sets of drawings, and one electronic copy of the shop drawings in pdf. The Architect will retain two sets, two will be returned to the Contractor, one to the District Project Manager and, one to the District Inspector. In some cases, contractor will be required to submit more than six copies. In such cases the actual number of sets required shall be as stated in the individual specification sections.

1.08 PRODUCT DATA:

A. Manufacturer's Standard Schematic Drawings:

1. Delete information, which is not applicable to Project. Failure to do so shall be grounds for rejecting the entire submittal.

2. Supplement standard Drawings to provide additional information applicable to Project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations, and other standard descriptive data:

1. Clearly mark each copy to identify pertinent materials, products, or models in terms of this contract.

2. Delete information, which is not applicable to Project. Failure to do so shall be grounds for rejecting the entire submittal.

3. Show dimensions and clearances required.

4. Show performance characteristics and capacities.

5. Show wiring diagrams and controls.

C. Copies Required and Distribution: Submit six (6) copies and one electronic copy in pdf. The Architect will retain two copies, two will be returned to the Contractor and two to the District Inspector.

1.09 SAMPLES:

A. Samples:

1. Submit samples of sufficient size and quantity to clearly illustrate:

a. Functional characteristics of product or material, with integral parts and attachment devices.

b. Full range of colors, textures, and patterns as required by this contract.

2. Provide permanent identification for each sample.

3. Color and pattern: Whenever a choice of color or pattern is available in a specified product, submit accurate color chips and pattern charts to the Architect for review and selection.

4. Number Required: Submit four of each. Architect and District will retain one each, one will be returned to the Contractor and one to the District Inspector. Additional samples shall be provided Architect at no cost for sample color boards if requested.

B. Field Samples and Mockups: When specified, erect field samples and mock-ups at the project site to illustrate materials, equipment, or workmanship and to establish standards by which completed work is judged.

C. After return of office samples or review of field samples, these items may be used in the construction of the project with the approval of the Architect.

1.10 COLOR SCHEDULES:

A. Following appropriate submittals by the Contractor, the District shall review and approve the color schedules prepared by the Architect, who will distribute the approved schedules to the Contractor and District Inspector.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 35 00

SPECIAL PROJECT PROCEDURES

PART 1 – MANAGEMENT PLAN

1.1 REQUIREMENTS OF THE IAQ MANAGEMENT PLAN

A. During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ guidelines for Occupied Buildings under Construction, 1995, Chapter 3.

B. Protect stored on-site or installed absorptive materials from moisture damage. Sources of moisture contamination include precipitation, air intakes, cleaning procedures, flushing procedures, testing procedures, leaks, etc. The approach for preventing moisture-related problems is to identify all sources of moisture and to keep materials from getting wet. Porous or absorptive materials including insulation, ceiling tiles, carpeting, etc. that become damp or wet shall be dried immediately; and any of these materials that remain wet or damp for more than 4 hours shall be replaced with new materials. An exception to this made be made at the owner's discretion with respect to carpet tile. In this case, if found wet, the carpeting may be re-used if it is immediately professionally cleaned, sanitized and vacuumed so that it is dry within 4 hours of cleaning. Also, any materials found to have mold or mildew odors shall be replaced with new materials. This is the responsibility of All Contractors.

C. If air handlers must be used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grill, as determined by ASHRAE 52.2-1999

D. Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value of 13, as determined by ASHRAE 52.2-1999 for media installed at the end of construction.

E. Provide cut sheets of filtration media used during construction and installed immediately prior to occupancy with MERV values highlighted.

F. Provide photographs of construction IAQ management measures such as protection of ducts and onsite stored or installed absorptive materials.

G. The IAQ Management Plan is a requirement to comply with Pre-requisite HPI-CHPs point EQ2.0A Minimum HVAC and Construction IEQ Requirements and Moisture Control.

PART 2 - MANAGEMENT PLAN SMACNA GUIDELINES

2.1 HVAC PROTECTION

A. The most significant potential IAQ contamination sources from construction are dust, moisture and Volatile Organic Compounds (VOCs). The approach for preventing dust-related problems is to identify all sources of dust and protect the HVAC systems. During construction, the return air system openings shall have temporary filters (min. MERV 8) that receive frequent periodic maintenance if the HVAC system is being utilized. When activities that produce high dust levels are occurring such as drywall sanding, masonry work, wood sawing, and insulating, the return system openings shall be sealed off completely for the duration of the task. This activity is the responsibility of the General Contractor and subcontractors.

B. The use of ventilation systems and air movers during construction shall be limited to 100% outside air (not re-circulating).

C. When the HVAC system is needed during construction operations, the supply system openings shall be covered with a particulate filter to prevent dust migration back up the supply side. This activity is the responsibility of the General Contractor and subcontractors.

D. If the HVAC is not used at times during construction, the supply and return air system openings shall be sealed off to prevent the migration and accumulation of dust and debris in the duct system. The diffusers (if installed) should also be sealed with plastic and low adhesion masking tape. This activity is the responsibility of the General Contractor and subcontractors.

E. Uninstalled ductwork and equipment must be stored away from dust-producing areas. Terminal units must be wrapped in plastic. Ducts sections must have ends capped with plastic. For installed ducts and equipment, provide protective caps at open ends. This is the responsibility of the Mechanical Contractor.

F. Filtration is critical during construction and during startup of the HVAC system. Filter media must meet the ASHRAE requirement for MERV Level 8. This is the responsibility of the Mechanical Contractor.

G. An HVAC system is determined to have excessive dust or debris when an accumulation of particles can be observed under (not on) diffusers, or ventilation is restricted. The General Contractor, Mechanical Contractor, Design Team and Bond Manager shall monitor the condition of the ducts during the construction process by periodic inspection to ensure that they are kept clean. If the ducts are found to be contaminated due to inadequate protection, the ducts shall be cleaned. The Commissioning Agent shall have the final authority as to the determination of the presence of excessive dust or debris and the adequacy of any cleaning operations.

H. For documentation that the above guidelines are followed during the construction phase of the project, pictures shall be taken bi-weekly by the General Contractor.

I. No storage shall be allowed in any mechanical rooms in the building, and any of these rooms requiring access by the contractor shall be kept neat and clean.

J. Replace filtration media immediately prior to occupancy. See specification for requirements. This is the responsibility the Mechanical Contractor.

2.2 SOURCE CONTROL

A. Use of low or no VOC products as indicated by the specifications shall be utilized to reduce potential problems. This activity shall be verified and checked by the General Contractor. Subcontractors are responsible for ensuring their products meet the requirements in the specifications.

B. During activities such as staining or finishing the General Contractor shall use large air movers (fans) to create immediate cross ventilation and constant fresh air.

C. No gasoline or diesel equipment shall be permitted into the building. Any cutting, drilling, or other activity shall be done with electric powered equipment or the machinery shall be located outside away from any doors or operable windows in the area. Subcontractors shall be responsible for coordinating these activities with the General Contractor.

D. No smoking shall be allowed in the onsite at any time. Subcontractors shall be responsible for taking their smoke breaks when normal break times occur and then only off the job site. Smoking is only permitted across 21st Avenue in the empty lot.

E. Containers of wet products are to be kept closed when not in use.

2.3 PATHWAY INTERRUPTION

A. At the “link” connection between the building and the existing building infection control procedures shall need to take place in order to not contaminate the occupied space. This shall require the construction of temporary walls to separate the construction area from the occupied area. Utilization of pressure differentials between the construction area and the occupied areas shall be needed to prevent contaminated air from entering clean areas. This shall also require ventilating using 100% outside air to exhaust contaminated air directly to the outside during installation of VOC-emitting materials.

B. Scrubbers shall be required with the use of equipment in the courtyard area if there are any operable windows or air intakes near.

2.4 HOUSEKEEPING

A. Institute cleaning activities concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to occupancy. All coils, air filters, and ductwork should remain clean during installation and should be cleaned prior to performing the testing, adjusting and balancing of the systems. This activity is the responsibility of the Mechanical Contractor.

B. The work area shall be vacuumed on a weekly basis, with a dual filter vacuum. This activity shall be the responsibility of the General Contractor.

C. Suppress dust with wetting agents or sweeping compounds. Use an efficient and effective dust collecting method such as a damp cloth, wet mop, or vacuum with particulate filters. Activities which produce high dust levels shall be cleaned up immediately upon completion or at the end each day the activity continues. This is the responsibility of all contractors.

D. Spills or excess applications of solvent-containing products must be removed immediately. This is the responsibility of all contractors.

E. All walls shall be dusted prior to application of finishes. This shall be the responsibility of the Painting Contractor.

F. All of the stud tracks are to be vacuumed prior to installation of insulation. This is the responsibility of the General Contractor.

G. Provide photographs during construction of the above activities to document compliance. This is the responsibility of the General Contractor to coordinate.

H. Building materials shall be stored in a clean area prior to unpacking for installation.

I. Materials which become contaminated through direct exposure to moisture from precipitation, plumbing leaks or condensation shall be replaced.

2.5 SCHEDULING

A. The primer and first coat of paint must be installed on all surfaces prior to the installation of carpet and ceiling tiles.

B. Only extremely low-VOC paint (5 g/L or less) may be installed after absorptive ceilings and floorings are installed.

C. All materials to be stained shall be stained off-site, with the exception of wood slat ceiling. Items to be stained on-site must be finished prior to installation of absorptive ceilings and floorings.

D. Move in shall not occur until after TCO is achieved. Completion of punch list items which shall not cause significant VOCs, dust or other contamination of the space may occur after occupancy only as necessary and as approved by the tenant.

2.6 MONITORING

A. Monitoring of the IAQ Plan shall be the responsibility of the General Contractor.

B. Contractor site coordination meetings are held weekly. At these meetings, the appropriate components of the IAQ Management Plan shall be reviewed as a regular action topic and the implementation of the plan shall be documented in the minutes of the meeting.

2.7 FLUSH-OUT AND/OR TESTING

A. Flushing out the building with 100% outside air will help remove indoor pollutants prior to occupancy. After construction ends, and with all interior finishes installed, flush-out the building by supplying continuous 24 hour ventilation with all air handling unit dampers at their maximum outdoor air position and all supply fans at their maximum position and maximum rate for at least 14 days while maintaining an internal temperature at the most energy efficient temperature above 60°F, and relative humidity no higher than 60%.

B. For the case where a potential CHPS project has fallen behind schedule and may be unable to complete all of the 14 day flush out prior to planned school occupancy date, the school may alternatively conduct the flush-out while the building is occupied provided all of the following measures to protect building occupants are taken:

1. All of the room's in the school must be inspected for health and thermal comfort by a trained technician or a certified Industrial Hygienist before occupancy. And the occupancy evaluation report which has been reviewed and approved by a certified Industrial Hygienists (i.e. certified by the American Council of Government and Industrial Hygienists (ACGIH)) shall be submitted to CHPS 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 (minimum MERV 8) as specified for the CHPS school project, the HVAC condensate pans drain correctly and the internal HVAC insulation is undamaged.
   c) Each classroom has been tested to show that the particulate matter, PM 10, has been measured to be 20 micrograms per cubic meter or less than the outdoor levels and the PM 2.5 12 micrograms per cubic meter or less than outdoor 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.

e) Each classroom has been tested to show that the carbon dioxide has been measured and is less than 200 ppm above outdoor CO 2 levels nearby. The room must be unoccupied during testing, and testing should occur during at least one rush-hour period.

f) Each classroom has been tested to show that the temperature and relative humidity have been measured and are within the criteria in ASHRAE Standard 55-2007.

g) 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.

PART 3 - CONCLUSION

The construction process is traditionally an indoor air polluting activity and often results in the contamination of buildings during construction as well as continued contamination after the building is occupied. The HVAC systems are especially prone to contamination from construction particulate matter that contains dust, VOCs, microorganisms and other contaminants. These contaminants can remain in the HVAC systems for years after occupancy. This plan's approach is to identify and document activities present on the site and reduce IAQ problems from dust, moisture and VOCs. Therefore, the strategies and activities outlined above in this plan minimize the construction contamination prior to building occupation.

END OF SECTION

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SECTION 01 40 00

REFERENCES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. General requirements for reference standards pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

1.02 REFERENCE AND STANDARD TYPE SPECIFICATIONS:

Specifying by reference to a reference and standard type specification document or to another portion of the Contract Documents shall be the same as if the referenced document or portion of the Contract Documents referred to were exactly repeated at the place where such reference is made. In case of a conflict between the requirements of regulatory agencies and the referenced and standard type specification documents, Contractor shall conform to the most restrictive requirement if such conformance is legal.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

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SECTION 01 40 50

OBSERVATION OF WORK

PART 1-GENERAL

The District will provide a Project Inspector, for this project.

Contractor shall submit an Inspection Request Form to the Project Inspector at least 48 hours prior to the time the inspection is needed, and on the form required. Contractor shall not cover any work requiring inspection until the Project Inspector has inspected and approved the subject work.

For work not in conformance with the Contract Documents, the Project Inspector shall submit to the Contractor a Deviation/Nonconforming Notice.

PART 2- PRODUCTS - NOT USED

PART 3 – EXECUTION - NOT USED

END OF SECTION

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SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTIION INCLUDES:

A. Regulatory requirements pertaining to the Work and is supplementary to all other regulatory requirements mentioned or referenced elsewhere in the Contract Documents.

1.02 REQUIREMENTS OF REGULATORY AGENCIES:

All pertaining statutes, ordinances, laws, rules, codes, regulations, standards, and the lawful orders of all public authorities having jurisdiction of the Work are hereby incorporated into these Contract Documents the same as if repeated in full herein and such are intended where any reference is made in either the singular or plural to Code or Building Code unless otherwise specified including, without limitation, those in the list below. Contractor shall make available at the site such copies of the listed documents applicable to the Work as the Architect or Owner may request including mentioned portions of the California Administrative Code (CAC).

A. With respect to the Division of the State of Architect and State Fire Marshal, California Building Code, most-recent adopted Edition.

B. Building Standards Administrative Code, Part 1, Title 24 C.C.R. latest Edition.

C. California Building Code (CBC), Part 2, Title 24, C.C.R. (International Building Code volumes 1-3 and California Amendments) Latest Editions.

D. California Electrical Code (CEC), Part 3, Title 24, C.C.R. (National Electrical Code and California Amendments) Latest Editions

E. California Mechanical Code (CMC), Part 4, Title 24 C.C.R. (Uniform Mechanical Code and California Amendments) Latest Editions

F. California Plumbing Code (CPC), Part 5, Title 24 C.C.R. (Uniform Plumbing Code and California Amendments) Latest Editions

G. California Fire Code, Part 9, Title 24 C.C.R. (Uniform Fire Code and California Amendments) Latest Editions.

H. California Referenced Standards, Part 12, Title 24, C.C.R., Latest Edition

I. California Energy Code, Part 6, title 24, C.C.R., Latest Edition

J. Title 19 C.C.R. Public Safety, State Fire Marshal Regulations, Latest Editions and Amendments

K. State and Local Public Health Codes, Latest Editions and Amendments

L. Other statutes, ordinances, laws, regulations, rules, orders, and codes specified in other Sections of the Specifications or bearing on the Work.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 01 42 00

TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing and inspection services to meet requirements of the California Building Code (CBC), Title 24, Parts 1 and 2, as indicated on the Drawings.

B. Tests of materials are required by a DSA certified testing agency as set forth in Section 4-335 of the California Building Standards Administrative Code.

1.2 RELATED SECTIONS

Provisions of the General Conditions, Supplemental Conditions and Division 01 apply to this Specification. Specifications that are referenced or related may include:

A. Section 01 31 00: Project Coordination

B. Section 01 73 29: Cutting and Patching

C. Section 01 33 00: Submittals

D. Section 01 32 00: Construction Schedule

E. Section 01 50 00: Construction Facilities and Temporary Controls

F. Section 01 77 00: Project Closeout

G. Section 01 78 23: Warranties

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.1 TESTS

A. OWNER will select and provide an independent DSA certified testing agency (the agency) to conduct tests, sampling, and testing of materials. Selection of material to be tested shall be by the agency and not by CONTRACTOR.

B. Any material shipped from the source of supply prior to having satisfactorily passed such testing and inspection, or prior to the receipt of notice from Project Inspector such testing and inspection is not required, shall not be incorporated into the Work.

C. OWNER will select, and directly reimburse, the agency for costs of all DSA required tests and inspections; however, the agency may be reimbursed by CONTRACTOR for such costs as specified or noted in related sections of the Contract Documents.

D. The independent testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

E. The agency shall not perform any duties of CONTRACTOR.

F. CONTRACTOR shall provide an insulated curing box with the capacity for twenty (20) concrete cylinders and will relocate said box and cylinders as rapidly as required in order to provide for progress of the Work.

3.2 TEST REPORTS

A. Test reports shall include all tests performed, regardless of whether such tests indicate the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations, when and as required, shall also be reported. Reports shall indicate the material (or materials) was sampled and tested in accordance with requirements of CBC, Title 24, Parts 1 and 2, as indicated on the Drawings. Test reports shall indicate specified design strength and specifically state whether or not the material (or materials) tested comply with the specified requirements.

1. The test reports shall incorporate all requirements of Title 24 Part 1, Section 4-335(d).

3.3 VERIFICATION OF TEST REPORTS

A. Each testing agency shall submit to the Division of the State Architect, in duplicate, a verified report covering all tests required to be performed by that agency during the progress of the Work. Such report, covering all required tests, shall be furnished prior to Substantial Completion and/or, when construction on the Work is suspended, covering all tests up to the time of Work suspension.

1. The test reports shall incorporate all requirements of Title 24 Part 1, Section 4-335(e).

3.4 INSPECTION BY OWNER

A. OWNER, and its representatives, shall have access, for purposes of inspection, at all times to all parts of the Work and to all shops wherein the Work is in preparation. CONTRACTOR shall, at all times, maintain proper facilities and provide safe access for such inspection.

B. OAR shall have the right to reject materials and/or workmanship deemed defective Work and to require correction. Defective workmanship shall be corrected in a satisfactory manner and defective materials shall be removed from the premises and legally disposed of without charge to OWNER. If CONTRACTOR does not correct such defective Work within a reasonable time, fixed by written notice and in accordance with the terms and conditions of the Contract Documents, OWNER may correct such defective Work and proceed in accordance with related Articles of the Contract Documents.

C. CONTRACTOR is responsible for compliance to all applicable local, state, and federal regulations regarding codes, regulations, ordinances, restrictions, and requirements.

3.5 INSPECTOR OF RECORD

A. A DSA approved and certified Project Inspector shall be employed by OWNER in accordance with requirements of Title 24 of the California Code of Regulations with their duties specifically defined therein. Additional DSA certified inspectors may be employed and assigned to the Work by OWNER in accordance with the requirements of California Building Standards Administrative Code with their duties as specifically defined in Section 4-333(b).

B. Inspection of Work shall not relieve CONTRACTOR from any obligation to fulfill all terms and conditions of the Contract Documents.

C. CONTRACTOR shall be responsible for scheduling times of inspection, tests, sample taking, and similar activities of the Work.

3.6 TESTS AND INSPECTIONS

The following tests and inspections do not limit inspection of the Work but are required by DSA, other agencies, or are required in related Sections of the Contract Documents.

A. Excavations, Foundations and Retaining Walls - CBC, Chapter 18A:

1. Inspection:

a. Excavation, Filling and Compaction	1701A.5.13

B. Concrete - CBC, Chapter 19A:

1. Materials:	
a. Test of Materials	1903A.1; 1916A.1 – ACI 318
b. Portland Cement Tests	1903A.3; 1916A.1 – ASTM C 150
c. Concrete Aggregate	1903A.5 – ACI 318
d. Reinforcing Bars	1903A.7; 1916A.2 – ACI 318
e. Structural Steel, Steel Pipe or Tubing	ACI 318 Sec. 3.5.6
f. Admixtures	ACI 318 Sec. 3.6
2. Quality:	
a. Proportions of Concrete	1905A.1; 1905A.2; 1905A.3; 1905A.4; 1905A.5; 1905A.6; 1905A.7 1904A.
b. Mixing and Placing	1905A.1.1; 1905A.2; 1905A.3, 1905A.4
c. Concrete Testing	1905A – ACI 318
d. Insulating Concrete Tests	1701A.5.9
3. Inspection:	
a. Project Site Inspection	1704A
b. Batch Plant or Weigh-master Inspection	1704A.4.2; 1704A.4.3
c. Reinforcing Bar Welding Inspection	1704A.3.1.3

C. Aluminum - CBC, Chapter 20A:

1. Aluminum	2002.1
2. Inspection:	2003.1

D. Masonry - CBC, Chapter 21A:

1. Materials:	
a. Masonry Units	2103A.1,2,3,4,5,6,7
b. Portland Cement	2103A.10.7
c. Mortar & Grout Aggregates	2103A.12
d. Reinforcing Bars	2103A.13
2. Quality:	
a. Portland Cement Tests	2105A.1, 2105A.2
b. Mortar & Grout Tests	2105A.5
c. Masonry Prism Tests	2105A.3
d. Masonry Core Tests	2105A.4
e. Reinforcing Bars	2103A.13
3. Inspection:	
a. Reinforced Masonry	1704A.5;1704A.5.3,
b. Reinforcing Bar Welding Inspection	1704A.3.1

E. Steel - CBC, Chapters 17A & 22A:

1. Materials:	
a. Structural Steel & Cold Formed Steel	2202A.1; 2205A
b. Material Identification	2203.A

2. Inspection and Tests:

a. Test of Structural Steel	1704A.3; 2212.A Table 1704A.3.
b. Tests of High Strength Bolts,	1704A.3.3; 2212.A.1
c. Tests of End Welded Studs	1704A.3.1: 2212A.2
d. Shop Fabrication Inspection	1704A.3.2.1
e. Welding Inspection	1704A.3.1
f. High Strength Bolt Inspection	1704A.3.3
h. Spray applied fire resistance materials	1701A
i. Non-Destructive Items	1703A
j. End-Welded Studs Inspection	2212A.2

F. Exterior Wall Coverings - CBC, Chapter 14A, 25A:

1. Materials:

a. Portland Cement Plaster	2510

2. Inspection:

a. Veneer Inspection	1405A.4

END OF SECTION

SECTION 01 42 01

ABBREVIATIONS, SYMBOLS AND ACRONYMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section lists the abbreviations, symbols and acronyms used in these specifications.

1.02 ABBREVIATIONS:

ac	Alternating current
BTU	British thermal unit
cfh	Cubic feet per hour
cfm	Cubic feet per minute
cm	Centimeter
Co.	Company
COP	Coefficient of performance
Corp.	Corporation
d.	Penny
db.	Decibel
DB	Dry bulb
dc	Direct current
EER	Energy efficiency ratio
F	Degrees Fahrenheit
fpm	Feet per minute
gap	Gallons per hour
GPM	Gallons per minute
HP	Horsepower
HVAC	Heating, ventilating and air conditioning
Hz	Hertz
Inc.	Incorporated
KHz	Kilohertz
lb	Pound
LED	Light emitting diode
MBH	100 BTUs per hour
MHz	Mega hertz
mil	Thousandth of an inch
mm	Millimeter
mph	Miles per hour
oz.	Ounce
pH	Acidity-alkalinity balance
psf	Pounds per square foot
psi	Pounds per square inch
psig	Pounds per square inch, gauge
RF	Radio frequency
rpm	Revolutions per minute
V	Volt
WB	Web bulb
#	Number
'	Foot/Feet
"	Inch (es)
%	Percent

1.03 ACRONYMS:

ABMA	American Boiler Manufacturers Association
ABMS	American Bureau of metal Statistics
ABPA	American Board Products Association
ACI	American Concrete Institute
AGA	American Gas Association
AHAM	Association of Heating and Air Conditioning Manufacturers
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning Association, Inc.
ANSI	American National Standards Institute
APA	American Plywood Association
AQMD	Air Quality Management District
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
CAC	California Administrative Code
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CQC	California Quality Control (CMA Standards)
CRA	California Redwood Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standards, U.S. Department of Commerce
CTI	Ceramic Tile Institute
CTI	Cooling Tower Institute
DHI	Door and Hardware Institute
FCC	Federal Communication Commission
FGMA	Flat Glass Marketing Association
FM	Factory Mutual
FS	Federal Specifications
HPMA	Hardwood Plywood Manufacturers Association
IAMPO	International Association of Plumbing and Mechanical Officials
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical & Electronic Engineers, Inc.
IES	Illuminating Engineering Society
IMI	International Masonry Institute
IRI	Industrial Risk Insurers
MIA	Marble Institute of America
MIA	Masonry Institute of America
MLSFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSS	Manufacturers Standardization Society of the Valve & Fittings Industry.

NAAMM	National Association of Architectural Metal Manufacturers
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NOFMA	National Oak Flooring Manufacturers Association
NPCA	National Paint and Coatings Association
NSF	National Sanitation Foundation
NTMA	National Terrazzo & Mosaic Association
NWMA	National Woodwork Manufacturers Association
OSA	Office of the State Architect
PCA	Portland Cement Association
PCI	Pre-stressed Concrete Institute
PDCA	Painting and Decorating Contractors of America
PDI	Plumbing and Drainage Institute
PEI	Porcelain Enamel Institute
PS	Product Standard, U.S. Department of Commerce
RCSB	Red Cedar Shingle and Hand split Shake Bureau
RIS	Redwood Inspection Service
RFCI	Resilient Floor Covering Institute
SCMA	Southern Cypress Manufacturers Association
SDI	Steel Deck Institute
SDI	Steel Door Institute
SFPA	Southern Forest Products Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractor National Association
SPIB	Southern Pine Inspection Bureau
SPR	Simplified Practice Recommendations, U.S.
SSPC	Steel Structure Painting Council
SWI	Steel Window Institute
TCA	Tile Council of America
UBC	Uniform Building Code
UCI	Uniform Construction Index
UL	Underwriters' Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
WCLIB	West Coast Lumber Inspection Bureau
WIC	Woodwork Institute of California
WWPA	Western Wood Products Association

END OF SECTION

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SECTION 01 43 00

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. All inspection and testing required to establish compliance with Contract Documents and Title 24 CCR requirements, except as may be otherwise specified, shall be made by an independent professional testing agency or firm selected and paid by the Owner/District (or as otherwise noted). All work prior to the call out of the inspection services shall be approved by the Project Inspector as ready for the inspection services.

B. The cost of most services for testing and inspection in compliance with Contract Documents requirements will be paid by the Owner. If initial tests indicate non-compliance with Contract Document requirements, any non-compliance testing shall be performed by the same inspection service and back charged to the General Contractor. Schedule portions of the work requiring testing and inspection services so that the time of the agency on the work is as continuous and brief as possible. Should an inspection service be called out without proper pre-inspection and approval by the Inspector of Record, and the Contractor causes the inspection service to be on site for longer than the minimum call-out costs, or the Contractor causes the inspection service to make a return call to the site for the same inspection, the additional costs shall be back-charged to the Contractor.

C. Concrete Coring Procedures: Prior to the start of any concrete coring, the Contractor shall submit a detailed coring plan, indicating the size and precise locations of the cores, for approval by the Architectural Team/Structural Engineer. Proposed coring locations must be marked in the field and verified by the District Project Inspector. The project Architectural Team/Structural Engineer may also request to perform a field inspection if deemed necessary. The Contractor SHALL arrange for and bear the costs of all Pachometer tests of the areas to be cored.

1.02 CONTRACTOR'S RESPONSIBILITY

A. Coordination: The Contractor shall initiate and coordinate testing and inspections required by the Contract Documents and public authorities having jurisdiction over the work through the Architect and/or Inspector of Record.

B. Access: Furnish free and safe access to the various parts of the work and assist testing and inspection personnel in the performance of their duties at no additional cost to the Owner.

C. Data: Furnish records, drawings, certificates, and similar data as may be required by the testing and inspection personnel to assure compliance with the Contract Documents.

D. Notification: Provide the Architect and/or Project Inspector and Testing Laboratory with at least 72 hours advance notification of required testing.

E. Defective work: Remove and replace any work found defective or not complying with Contract Document requirements at no additional costs to the Owner (shall apply to 1, 2, and 3 immediately below). Where testing personnel take cores or cut-outs to verify compliance, repair prior to acceptance and as approved by the District Project Inspector.

1. Concrete: If test cylinders for concrete fail to meet design stresses, make core and load tests as may be directed by the Design Professional; make core tests in accordance with an ASTM C42 or most recent update and load tests in accordance

with ACI 318 or most recent update. Correct all deficiencies found in forms, reinforcing steel and embedded items.

2. Structural Steel: Should any weld or structural connection fail to meet design stresses, provide sonic or x-ray examination of all structural connections as directed by the Architect/engineer. Replace or repair all defective connections as directed.

3. Roofing membrane work: Should roofing membrane, including associated flashing and jointing, indicate non-compliance with Contract Document requirements, provide corrective work as directed.

F. Lead Levels in Water: The domestic water piping system shall be protected during tie-ins or other construction activities that have the potential to elevate the lead levels in the water. The water in the domestic water piping shall be tested prior to the start of work and the lead levels documented. Testing shall also be performed upon the completion of all work and any lead contamination, above the levels documented prior to the start of work shall be the Contractors responsibility to reduce the levels to the pre-project levels.

1. If the domestic water system is contaminated as a result of construction activities, the Contractor shall decontaminate the domestic water system. The procedures shall comply with applicable regulatory requirements.

1.03 TESTING LABORATORY RESPONSIBILITY

A. Taking Specimens: Specimens and samples for testing, unless otherwise provided in the Contract Documents, will be taken by the testing personnel. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples of the testing laboratory will be performed by the testing laboratory.

1. When the testing laboratory is ready to test but is prevented from testing or taking specimens due to incompleteness of the work or other scheduling lapses, all extra charges for testing attributable to the delay may be back-charged to the Contractor and shall not be borne by the Owner.

B. Test Reports: Reports shall include all tests made, regardless of whether such tests indicate that material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Reports shall state which requirements with which the material or materials were sampled and tested. Test reports shall show the indicated or specified design strength(s) and state definitely whether or not the materials tested comply with the specification requirements.

Report distribution shall be made as follows:

Owner's Rep	1 copy, and 1 electronic pdf
Architect	1 copy, and 1 electronic pdf
Structural Engineer	1 copy
Contractor	2 copies
DSA	2 copies (or as required by DSA)

C. The inspection agency shall cooperate with the Contractor so as to cause no delay in the progress of the work but shall be directly responsible to the Owner for his actions. The inspection agency shall have no authority to direct the work of the Contractor.

D. Submittals: Promptly submit copies of reports of inspections and tests, mill analysis, concrete mix designs and certifications per applicable sections of the specification.

1. Comply with requirements of each technical specification section and DSA requirements.

2. Reports shall include all tests made, regardless of whether such test indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be

reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were samples and tested in accordance with the requirements of the Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state definitely whether or not the material or materials tested comply with requirements.

3. Testing Agency is not authorized to:

   a. Release, revoke, alter, or enlarge on, requirements of Contract Documents.

   b. Perform any duties of the Contractor.

1.04 REQUIRED INSPECTIONS & TESTS

The following are inspection services and tests required of but not limited to the Inspection and Testing Agency.

A. Sitework inspections & tests: Perform the following services as required to assure compliance with requirements of Division 2 of the technical specifications.

Compaction & bearing: Test and verify bearing capacity of all load bearing earth, test compaction fills for compliance with required densities.

B. Concrete work inspections & tests: Perform the following services as required to assure compliance with requirements of Division 3 of the technical specifications.

1. Cast-in-place concrete: Make slump tests for each batch delivered or at least 1 test per hour during continuous pours in accordance with requirements of ASTM C143; check and verify batch consistency. Inspect forms and verify sizes and conditions. Inspect reinforcing and verify its proper placement. Furnish continuous inspection during replacement, repair and patching operations, and curing of concrete. Make cure, and test at least 3 test cylinders of each strength, of concrete for each 50 cubic yards (38.23 m3) placed or for each day's pour, whichever is greater. Report exact mix tested, minimum size aggregate, location of pour in the work, cylinder identification, data of receipt of cylinder in laboratory, slump data, cement brand and type, admixtures used, dates and records offset cylinders, names of inspectors and laboratory personnel, and evaluation or analysis of cause, in case of test failure, and recommendations of remedial action.

2. Cure specimens under laboratory conditions except when there is possibility of surrounding air temperature falling at project below 40F. In this case, additional specimens will be required to be cured under job conditions. For all test unless otherwise directed, break 1 cylinder at 7 days, 2 at 28 days.

3. If 7 day tests appear to be marginal or fall below normal requirements, concrete shall be tested with an approved impact hammer. Should these readings verify low test cylinders, procedure of work beyond this point will be Contractor's responsibility until decision is reached as to removal of substandard concrete at each of 28 day period.

C. Metal work inspection & tests: Perform the following services as required to assure compliance with requirements of Division 5 of the technical specifications.

1. Structural steel fabrication: Furnish visual inspection of all shop fabricated parts including joists and joist girders. This inspection may be done in shop or in field after delivery. Furnish inspection and testing of shop welds in accordance with requirements for welding specification hereinafter. Check shapes, sizes, classes, and types of steel. Verify conformance of structural steel materials with requirements of Contract Documents. Test end welded studs and replace studs damaged by test.

2. Structural steel field inspection & tests: Check location and fit of all anchorage and inserts. Verify adjustments to fit inaccuracies. Furnish visual inspection of erection of all structural steel components of the work. Furnish inspection and testing of all field welding in accordance with requirements for welding in accordance with requirements for bolting specific hereinafter. Inspect and test all bolted connections in accordance with requirements for welding specified hereinafter. Inspect for compliance with AISC Code of Standard Practice with requirements of the Contract Documents; other duties and responsibilities as may be noted on drawing.

3. Welding requirements: Furnish visual inspection of all field fillet welding. Furnish inspection of fillet welds in accordance with requirements of AWS D1.1 (Rev. I): allow for inspection of a minimum of 15% of fillet welds by magnetic particle or dry penetrant methods

4. Bolting requirements: Furnish visual inspection of structural joints where ASTM A325 bolts are used; verify the applicable requirements of AISC specifications are met.

D. Thermal and moisture protection work testing & inspection: Perform services as required to assure compliance with requirements of Division 7 of the technical specification.

E. Roofing: Check deck surfaces prior to application of roofing materials and verify that substrate is in satisfactory conditions to receive roofing. Furnish continuous inspection during application of roofing, including application of vapor barriers, insulation and roofing. Inspect all sheet metal flashings, counterflashing and reglets for satisfactory and waterproof installation.

F. Wood: Check framing lumber moisture content prior to framing.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 45 00

SAFETY PROCEDURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall ensure that all employees, visitors, subcontractors, subcontractor employees, and suppliers, while on the worksite, comply with the requirements of OSHA, these requirements, and the safety precautions contained in the several Specification Sections.

B. The Contractor shall promptly and fully comply with and execute, without separate charge thereof to the District, shall enforce compliance with the provisions of the Williams Steiger Occupational Safety Health Act of 1970 (Public Law 91-596 with most recent updates and amendments) with particular attention paid, but not limited to, Title 29-Labor, Chapter XVII - Occupational Safety and Health Administration, Department of Labor Part 1926 - (Safety and Health Regulations for Construction), and part 1910 - (Occupational Safety and Health Standards), as printed, respectively, in the June 24, 1974, and June 27, 1974, Federal Register, and latest adopted amendments and changes thereto.

1.02 PRELIMINARY WORK

A. Prior to the start of and during the course of the work (above and below ground) the Contractor shall make a thorough survey of the entire worksite to determine all potential hazards. Workmen shall be made aware of those hazards and shall be instructed in procedures and the use of equipment for their protection. The Contractor shall verify the location and condition (“live” or “dead”) of all utilities on and near the worksite and take precautions to protect his employees, subcontractors, material men, the general public, and the property.

1.03 IMMINENT DANGER

A. The District may stop those operations which create an imminent danger to employees (as defined by OSHA), to the public and to property.

B. The Contractor shall be wholly responsible for any accident (including death) occurring at any time during the progress of the work and until the final acceptance of the work by the District which may happen to any of his employees/workmen or those of any Subcontractor employed on the building, the property, or for any damage or injuries (including death) which his work and operations may cause to the work being constructed, or to existing buildings, or to any tenants and occupants of the property, or of the adjoining properties, or to the public, or to any public or private property.

1.04 COOPERATION:

A. The Contractor shall cooperate with the safety representatives of the District, District's Insurance Managers and the District's Insurance Company in any and all inquiries before, during, and after the project.

1.05 SAFETY RESPONSIBILITIES:

A. Contractor's Superintendent shall:

1. Ensure compliance with these requirements, OSHA requirements and other safety requirements, and provide and implement an Injury and Illness Prevention Program (IIPP) at the project site.

2. Provide, supervise, and support a Contractor's Project Safety Supervisor and enable him/her to execute effectively their duties and responsibilities.

3. Authorize immediate action to correct substandard safety conditions.

4. Review and act to ensure compliance with safety procedures with his supervisors, subcontractors and suppliers.

5. Take an active part in all supervisory safety meetings.

6. Cooperate with safety representatives of the District, District Insurance Managers, and the District's insurance company.

7. Ensure that all security and temporary fencing has been secured to prevent any movement or causal action that could contribute to any hazardous or unsafe condition, or which ultimately may cause harm.

B. Contractor's Project Safety Supervisor shall:

1. Make thorough daily safety inspections of the worksite and immediately act to eliminate unsafe acts and unsafe conditions, and record all suggestions make and corrective action taken.

2. Investigate worksite accidents and recommend immediate corrective action.

3. **Weekly safety meetings shall be conducted and documented in the daily report of activity by the contractor. Weekly safety meeting notes shall be recorded, noting the contractors and trades on site, the topics that were discussed and the attendance by contractor name, workmen name and trade, in attendance on the project that day.**

4. Review safety meetings reports submitted by job foremen and act to ensure that meaningful weekly safety meetings are held by the job foremen.

5. Attend foremen "tool box" safety meetings and evaluate effectiveness.

6. Assist in the preparation of accident investigation and reporting procedures.

7. Implement training programs for supervisors and employees as they apply to their specific responsibilities.

8. Be responsible for the control, availability, and use of safety equipment, including employee personal protective equipment.

9. Coordinate his activities with those of the District's Inspector and/or Project Manager, and immediately implement their safety suggestions.

10. Coordinate public relations aspects of the Contractor's safety program.

C. Contractor's Job Foreman shall:

1. Instruct workmen regarding safe work practices and work methods at the time workmen are given work assignments.

2. Furnish and enforce the use of personal protective equipment and suitable tools that are equipped with all the manufacturer's supplied safety features, and have not been altered in any way, for the job.

3. Continuously check to see that no unsafe practices and conditions are allowed to exist on this portion of the work.

4. Set a good example for his personnel.

5. Make a complete investigation of accidents to determine facts necessary to take corrective action to prevent a recurrence, and record the facts in a written report to accompany the daily report as set forth in the IIPP.

6. Promptly supply information for, or complete, an Accident Report and Investigation Form as directed by the Contractor Safety Supervisor and Contractor's Superintendent/Project Manager.

7. Hold weekly "tool box" safety meetings with his personnel to:

a. Discuss observed unsafe work practices and unsafe conditions.

b. Review the accident experience of his crew and discuss correction of the accident causes.

c. Encourage safety suggestions from his crew and report those suggestions to the Safety Supervisor.

8. Ensure that first aid is promptly administered to an injured employee.

9. Report immediately, to Contractor's Superintendent/Project Manager, or Safety Supervisor, any injuries, or violations of job safety and security.

D. Subcontractor's Job Superintendent shall:

1. Plan and execute his work so as to comply with the Construction Safety Program.

2. Furnish and enforce the use of personal protective equipment.

3. Attend supervisory personnel safety meetings schedule by the Contractor.

4. Schedule and attend weekly "tool box" safety meetings to be held by job foremen for all employees.

5. Report to the Contractor's Project Safety Supervisor or Contractor's Superintendent all observed unsafe conditions, unsafe practices, and violations of job security.

6. Cooperate with the District's safety representative.

1.06 CONTRACTOR'S SAFETY SUPERVISOR:

A. Contractor shall designate a full-time employee as Contractor Project Safety Supervisor.

B. Qualifications must be approved by the District. Supervisor shall:

1. Have heavy construction experience of not less than three (3) years, one of which must have been in a supervisory capacity.

2. Be familiar with job safety laws and regulations.

3. Have accident prevention experience.

C. Duties: Project Safety Supervisor shall conduct regular inspections of the work, shall ensure compliance with job safety requirements, shall maintain the Contractor's safety program IIPP on site and available for review by the District's Inspector and/or Project Manager and shall enforce safe practices, use of safety equipment and personal protective equipment, and other such activities as may be required by OSHA, the safety requirements, and the safety precautions contained in the several Specification Sections.

D. If the Project Safety Supervisor is not effective in executing the duties assigned him, the District may request, in writing, that the Contractor furnish a new Project Safety Supervisor.

E. If the Contractor desires to replace the Project Safety Supervisor, he shall so notify the District and the District's Insurance Managers, in writing and shall submit the name, experience and qualifications of the proposed Project Safety Supervisor for approval.

1.07 REQUEST FOR VARIANCES

A. Request for variances to deviate from OSHA requirements must follow the current established procedures by that Agency.

1.08 FAILURE TO COMPLY

A. If the Contractor fails to comply with the requirements of OSHA, the safety requirements, and the safety precautions contained in the Specifications Sections, or to provide an on-site IIPP, the District may modify or stop the work and portions thereof, until such failure is remedied. Willful and repeated failure to comply could result in the shutdown of the work, and portions thereof. No part of the time lost due to any such modification of operations or stop orders shall be made the subject of a claim for extension of time or for increased costs of damage by the Contractor.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Temporary utilities, construction trailers/facilities and project sign(s) which are to be provided and maintained by the Contractor.

B. Dust and noise control.

C. General temporary items including staging area for material delivery and safety and security lighting.

1.02 TEMPORARY UTILITIES:

A. Water:

1. Arrange for water with District Construction/Project Manager and install all necessary water lines, connections and metering devices for project, and upon completion of the work, remove such temporary facilities.

2. District will pay for all water needed for construction. Water conservation techniques are to be observed by all workmen. Contractor is to provide and maintain all water conveyance equipment, hoses, nozzles, hose bib connections, free from leaks, and equip all hoses with positive closing, hand-squeeze-type operating nozzles - - it is not permitted to operate a hose without a positive closing nozzle.

3. Provide suitable drainage system, subject to the approval of the Architect/Engineer and as indicated on the approved SWPPP, to carry construction waste water from site to an approved disposal location.

B. Electricity:

1. District will pay for all electricity needed for construction. Contractor is to arrange for and install all necessary temporary poles, wiring and metering devices and, upon completion of the work, remove such temporary facilities. Electricity conservation best management practices shall be observed by all workmen, and any unnecessary lighting, or electrical discharge shall be turned off at the end of each shift. Only safety lighting is allowed after each shift is concluded.

2. Furnish and install area distribution boxes, so located that the individual trades may use 100 foot maximum length extension cords to obtain adequate power and work task lighting, at points where required for the work, for inspection and for safety.

3. Provide all electricity needed for construction including connections for construction equipment requiring power.

4. Lighting in the construction work area shall be sufficient to allow safe travel for workmen and the Architectural team during normal working hours of the project and shall be shut down to conserve energy after normal construction working hours.

C. Natural Gas: The Contractor shall provide and install gas equipment and piping necessary to perform his work and shall remove same upon completion of the work. **The Contractor shall pay for the Natural gas used in the work**.

D. Telephone/Communications/Data:

1. Make necessary arrangements and pay costs for installation and operation of telephone, communication, or data service to the Contractor's office at the site.

E. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of the work.

F. Make required connections to existing utility systems with minimum disruption to services in the existing utility systems. When disruption of the existing service is required, do not proceed without the Architect and/or Inspector's approval with at least 72 hours written request and approval. When required, provide alternate temporary service, should it be necessary as deemed by the Architect and/or Inspector, or Project Manager.

1.03 CONTRACTOR'S FACILITIES:

Contractor shall provide temporary offices, storage sheds, fencing, barricades, signage, hoists, scaffolds, railings and other facilities as required and specified. Installation and maintenance of such items shall be the responsibility of the Contractor.

A. Temporary Offices for Contractor, the District Project Manager and District Project Inspector.

1. The contractor shall provide and maintain two trailers on the site for the duration of the project, up to and including the date the Certificate of Occupancy will be filed by the District with the Board of Education.

2. One trailer shall be for the use of the general contractor, and the other trailer shall be for the use of both the District Project Manager, and the District Project Inspector.

2. Both trailers shall have ample headroom; shall be properly lighted, heated and ventilated, and supplied with air conditioning sufficient to properly heat and cool the trailer between 68 and 76 degrees Fahrenheit on any day during construction.

3. The trailer for the District Project Manager, and the District Project Inspector shall have a minimum of two separate entrances with an office space for each separated by an interior wall and lockable door, and each space shall be provided with a telephone line, fax line, and high speed internet service, with a new or refurbished office desk at least 30" x 60" in size, with drawers that operate, with a drawer for miscellaneous office supplies, a drawer to accommodate 8 1/2 x 11 size file folders, one drawer to accommodate bulk office supplies, one new or refurbished office chair with casters, one new or refurbished side chairs with casters, a worktable or drawing table in sufficient size to lay out a full size set of project drawings, and one shelf at least 12" deep by 48" in length and secured for safely storing project specifications, project binders, and code books..

5. The Contractor shall provide temporary toilet facilities and wash sinks within close proximity (no more than 30 feet) to the trailer for the District Project Manager, and the District Inspector, which facilities shall be maintained as recommended by the supplier and common industry standards.

3. The trailers, equipment and the furniture shall remain the Contractor's property. Contractor shall remove such property upon completion of the work and the filing of the Certificate of Occupancy by the District.

B. Sanitary Facilities:

1. The Contractor shall provide temporary toilet facilities which may consist of portable chemical toilets, and hand washing equipment. Number of toilets shall be based on number of workers with a minimum of 1 toilet facility per 10 workers. Placement of

temporary toilet facilities shall be agreed upon at the site with the District Construction/Project Manager.

2. Toilet facilities shall be kept supplied with toilet paper and kept in a clean and sanitary condition until completion of the work, and then be removed from the work site. Upon removal, that portion of the site shall be properly cleaned and graded/repaired.

C. Contractor's Security Barricade:

1. The Contractor shall erect the temporary security barricades for the purpose of defining construction lay-down areas, staging area and work zones. Temporary security barricades shall be provided on school site at exterior locations, and at building interiors, as necessary to provide a clear, obvious separation between school users and construction personnel. New or used material may be used.

2. Unless otherwise indicated or specified, barricade shall be constructed of 6'-0" high chain link fence material with T-post condition at bottom for stability, shall have top rails, and 6 gauge minimum wire support at the bottom, BLACK screen material securely attached to the chain link material. Space posts not to exceed 10 feet on centers. Posts shall be of the following nominal pipe dimensions: terminal, corner, and gate posts 2-1/2", line posts 2", with diagonal supports at each corner. Chain link fabric shall be not less than 13 gauge, 2" mesh, and in one width. Posts, fabric and accessories shall be galvanized. Some fencing may require terminal posts to be sunk in the ground, or with appropriately placed concrete footings, and/or may require sandbags for ballast, as determined by the Inspector and/or Project Manager.

3. Chain link fencing shall be free from barbs, icicles or other projections resulting from the galvanizing process, and shall be knuckle-knuckle. Fence fabric having such defects will be rejected even though it has been erected.

4. Gates shall be fabricated of steel pipe with welded corners, and horizontal and diagonal bracing as required to prevent flexing. Fabric to be attached to the frame at 12 inch centers. Provide all gate hardware of a strength and quality to perform satisfactorily until the barricade is removed upon completion of the work. Provide locks sufficient to secure the area, and that can be opened with one hand (e.g. combination locks).

5. At the completion of the work, remove barricade and concrete post footings from the site; backfill and compact fence footing holes by patching with like materials. Existing surface paving that is cut into or removed shall be patched and sealed to match the surrounding areas with like materials, and in the same finishes.

6. Contractor shall maintain all fencing and gates in good order on a daily basis, including the masking of graffiti as deemed necessary by the Inspector, and/or Project Manager, and shall secure the project fencing and gates at the end of every work day.

D. Other Enclosures:

1. Provide temporary weather-tight enclosures at openings in exterior walls to create acceptable working conditions, and/or to allow for temporary heating and for necessary security.

2. Provide protective barriers that shall be at least 4' in height and extend to protect all areas at tree drip lines, around plants and other improvements designated to remain, as determined by the Inspector and/or Project Manager and related specification sections.

E. Storage Yards and Storage Containers:

1. The Contractor shall fence and maintain storage yards in an orderly manner.

2. Provide steel storage containers, lockable, free from graffiti, and in good condition for materials and equipment that cannot be stored offsite or in a bonded and agreed-upon warehouse.

3. Exact location, size and access of storage yards and steel storage containers shall be approved by the District Construction/Project Manager.

4. Remove storage yards and containers as rapidly as progress of the work will permit.

1.04 REQUIRED SIGNS AT GATES

A. Contractor shall post at the work site signs not greater than twenty-five feet (25') apart at all gates stating "Authorized Personnel Only – Construction Area" and "No Parking – Fire Lane," as determined by the contract specifications and drawings, and/or as designated by the Inspector and/or Project Manager

1.05 HARD HAT SIGN:

A. Contractor shall post a sign at each gate and/or entry to any area of construction, identifying the job site as a "hard hat area". No person without a hard hat shall be allowed in the sections of the project under construction. This shall be the responsibility of the Contractor's Project Safety Inspector to enforce.

1.06 DUST AND NOISE CONTROL:

A. Throughout the entire construction period, Contractor shall maintain dust control by use of water or other environmental controls as may be approved by the Architect, Inspector, and/or Project Manager.

B. Noise Control: Muffle all equipment to a maximum of 85 Dba at 5' from equipment. Noise control is to be kept to a minimum to perform the operations of construction. NO Radios or projected sound will be allowed on the job site.

1.07 GENERAL ITEMS:

A. Staging areas for delivery of materials and equipment will be at locations designated by the drawings and specifications, and/or as approved by the Architect, Inspector, and/or Project Manager.

B. Safety and Security Lighting: Provide 5 foot candles outside.

C. Noise Control: Muffle all equipment to a maximum of 85 Dba at 5' from equipment.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 53 50

PROTECTION OF INSTALLED WORK

PART 1-GENERAL

1.01 REQUIREMENTS INCLUDED

A. Protection for Products, including District - Provided Products, After Installation.

B. Protection of Existing Utilities and Interference.

1.02 EXISTING UTILITIES

A. The known existing utilities are shown on the drawings in their approximate location and the Prime Trade Contractor shall exercise care in avoiding damage to these facilities as the Prime Trade Contractor will be held responsible for their repair if damaged. Hand excavation shall be utilized when digging in close proximity to existing utilities. The District's Architectural Team does not guarantee that all utilities or obstructions are shown or that the locations indicated are accurate.

B. No work shall be performed on energized electrical equipment unless scheduled with the District Project Inspector. The District Inspector reserves the right to specify specific conditions for all work involving energized high voltage electrical equipment, and its scheduled modification proposal.

C. If interferences occur at locations other than the general locations shown on the plans, and such utilities are damaged before their locations have been established, or create an interference, the Prime Trade Contractor shall notify the District's Construction/Project Manager and a method for correcting said interference shall be supplied by the District's Engineering representatives. Payment for additional work due to interferences not shown on the plans shall be in accordance with the General Conditions.

D. Drawings showing location of equipment, piping, etc., are diagrammatic and job conditions will not always permit their installation in location shown. When this situation occurs, bring to the District Architect's, and/or Inspector's attention immediately to determine relocation in joint conference.

E. Information shown relative to existing power and signal service is based upon available records and data but shall be regarded as approximate only. Minor deviations found necessary to conform to actual locations and conditions shall be made without extra cost to the District.

PART 2- PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 PROTECTION AFTER INSTALLATION

A. Adequately protect all installed equipment and materials until completion and acceptance by the Architect, Inspector, and Project Manager.

B. Protect installed products and control traffic in immediate area to prevent damage in

subsequent operations.

C. Provide protective coverings at walls, projections, corners, and jambs, sills, and stiff openings in and adjacent to traffic areas.

D. Cover walls and floors of elevator cabs, and jambs of cab doors, when elevators are used by construction personnel. Protect elevator area until final acceptance.

E. Protect finished floors and stairs from dirt, wear, and damage:

1. Secure heavy sheet goods or similar protective materials in place, in areas subject to construction foot traffic, and/or material deliveries.

2. Lay planking or similar rigid materials in place, in areas subject to movement of heavy objects over existing surfaces.

3. Lay planking or similar rigid materials in place in areas where storage of products will occur.

F. Protect waterproofed and roofed surfaces:

1. Restrict use of surfaces for traffic of any kind, and for storage of products.

2. When an activity is mandatory, obtain recommendations for protection of surface from manufacturer. Install protection and remove on completion of activity. Restrict use of adjacent unprotected areas.

G. Restrict traffic of any kind across planted lawn and landscape areas through the use of temporary barricades, fencing, signage, and until final acceptance and maintenance period.

H. Care shall be exercised to prevent damage to adjacent facilities including walks, curbs, and gutters, etc. Where equipment will pass over these obstructions, suitable planking and protection shall be placed, and damaged facilities, due to the Contractor(s) operations, shall be removed and replaced at the Prime Trade Contractor's expense.

I. Prime Trade Contractor shall be responsible for overloading of any part or parts of structures beyond their safe calculated carrying capacities by placing of materials, equipment, tools machinery or any other item thereon.

J. All existing improvements and facilities shall be protected from damage of any type resulting from the operations, equipment or workers of the Contractor(s) during the time the project.

K. All damaged work shall be replaced, repaired and restored to its original condition with no additional cost to the District.

L. Where existing utilities are damaged or disrupted on account of any act, omission, neglect or misconduct by the Contractors in the manner or method of executing the work, or due to non-execution of work, such damage shall be immediately repaired to maintain operation regardless of the time of occurrence with no cost to the District.

M. Provide temporary construction necessary for protection of the building and their parts. Close buildings as soon as possible as protection from the weather and vandalism. Protect existing buildings and controlled temperature areas from excessive temperature variances below 68 degrees Fahrenheit, and above 76 degrees Fahrenheit, and from any damage.

N. Protect doors, millwork and mill counters and cases and hardware from damage, including abrading and scratching of finishes.

O. Protect doors and frames and hardware from mechanical damage and damage to finish coatings.

P. Remove protective coatings, wrappings, temporary coverings, etc., as required to leave work in condition for painting and finishing, final cleaning, etc.

Q. Protect all exterior work, including existing asphalt paving, concrete flatwork, common sidewalk, and City curb, gutter, and aprons. Protect all existing and newly placed landscaping and irrigation systems.

R. Repair or replace all damaged work promptly as directed by District Construction/Project Manager, District Inspector, or District Architect at no cost to the District.

END OF SECTION

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SECTION 01 54 00

SECURITY

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Security Program.

B. Entry Control.

C. Personnel Identification.

D. Miscellaneous Restrictions

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SECURITY PROGRAM

A. Protect work, existing premises, and School operations from theft, vandalism and unauthorized entry.

B. Security of the job area shall be strictly maintained. The Prime Trade Contractor shall be responsible for keeping areas involved in the work locked and secure at all times when work is not in progress, and no Contractor representative is on site.

3.02 ENTRY CONTROL

A. Restrict entrance of persons and vehicles into Project site and existing facilities under construction. Allow entrance only to authorized persons with proper identification, and appropriate footwear, and hard hats, as determined by the Contractor Project Safety Inspector, and/or District Inspector.

B. Prime Trade Contractor shall control entrance of own persons and vehicles related to construction operations in accordance with the conditions during work, and not allow intrusion by others.

3.03 BADGES AND ESCORT REQUIREMENTS

A. All personnel shall wear badges distinguishing personnel requiring an escort (YELLOW badges) to areas of the campus outside of the work area from those not requiring an escort (GREEN badges).

B. Personnel without fingerprint and acceptable background check on file with the District shall require an escort to any area outside of the work area.

C. The Contract and Pre-Construction meeting wording lays out the appropriate procedures for Contractor and Subcontractor personnel in working on the school site.

END OF SECTION

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SECTION 01 56 40

ENVIRONMENTAL MITIGATION

PART 1-GENERAL

1.01 SECTION INCLUDES

A. The Environmental Mitigation requirement for this project is recorded in this specification section 01 56 40. The measures mitigations may include, but are not limited to, procedures and standards to control:

1. Dust

2. Noise

3. Fumes

4. Timing of work activities

5. Erosion

6. Archaeological resources found during excavation

7. Preservation of trees

8. Demolition process and materials.

1.02 EXECUTION

A. The Contractor shall comply with the mitigation below in terms of what is to be controlled, acceptable methods, and standards (e.g. equipment must be muffled and noise levels may not exceed specified decibel levels).

B. The Contractor shall provide documentation of having met the mitigation requirements as described below to the Inspector and/or Project Manager within five (5) working days of the Notice to Proceed and at each phase of the project.

C. To reduce dust emissions and noise during construction by implementing the following:

1. Exposed surfaces should be watered twice daily.

2. Stockpiles of excavated materials should be covered.

3. Trucks carrying excavated materials from the site should be covered and should have their tires and undercarriages washed prior to exiting the site.

4. Streets affected by fugitive sand and dust are to be swept regularly by Prime Trade Contractors responsible for tracking of mud and/or sand to these streets.

5. Uncovered soil should be bound (by grass or similar groundcover) as soon as is reasonably possible.

6. Excavation should not be conducted when surface winds exceed 11 mph.

7. Unnecessary idling of construction vehicles and equipment should be avoided adjacent to areas of instruction, or adjacent to fresh air ductwork, or where noise will affect the areas of instruction.

8. Limit construction activities to a schedule that minimizes disruption as much as possible to area residences surrounding the project site property boundaries.

9. Schedule activities with the highest noise potential for the times when disruption of any instruction, or area of residences surrounding the project site will be at a minimum.

10. Require contractors to employ the lowest-decibel level equipment or employ alternative equipment or to muffle/control noise from available equipment to the maximum extent possible.

11. Perform noisy operations (e.g., mixing concrete, hydraulic/mechanical demolition) off-site or on portions of the site furthest from noise sensitive receptors whenever possible, and in consult with the Inspector and/or Project Manager.

END OF SECTION

SECTION 01 57 23

STORM WATER POLLUTION PREVENTION

PART I - GENERAL

1.01 SECTION INCLUDES

A. Preparation, implementation and monitoring of Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharge of pollutants from the construction site into the receiving waters.

NOTE: CONSTRUCTION SHALL NOT START UNTIL CONTRACTOR HAS PREPARED AND OBTAINED APPROVAL OF SWPPP IN CONJUNCTION WITH DISTRICT PROJECT MANAGER'S REGISTRATION WITH STATE DEPARTMENT OF WATER RESOURCES.

B. Compliance with local, state and federal regulations.

C. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) within the duration of the construction contract.

D. Certification that the construction project has met all of the conditions of the General Construction Activity Storm Water Permit (GCASP).

1.02 REFERENCES

A. California Storm Water Best Management Practice Handbook for Construction Activity (BMP Handbook - MOST RECENT REVISION TO DATE).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use materials of a class, grade and type needed to meet the performance described in the BMP Handbook.

PART 3 - EXECUTION

3.01 PREPARATION AND APPROVAL

A. Prepare the Storm Water Pollution Prevention Plan (SWPPP) as required to comply with storm water pollution regulations.

1. Use as a guide the BMP Handbook, MOST RECENT EDITIONS TO March 1993 edition, published by the Storm Water Quality Task Force.

B. Within two weeks after Award of Contract and Notice to Proceed by the District, submit to the Architect, 1 hard copy, and one electronic copy of the SWPPP for review and corrections. After the Architect's approval provide 3 ELECTRONIC copies of the corrected or modified SWPPP to the Architect.

C. On project sites that are 5 acres or more, submit to the District a completed Notice of Intent (NOI), and application fee payable to the State Water Resources Control Board with electronic copies of the approved SWPPP indicated in Paragraph B above.

3.02 IMPLEMENTATION

A. Install perimeter controls prior to starting other construction work at the site.

B. Contain on-site storm water at the jobsite. Do not drain on-site water directly into the storm drain.

C. Designate trained personnel for the proper implementation of the SWPPP.

D. Revise SWPPP to suit changing site conditions and also when properly installed systems are ineffective.

E. At the end of Construction Contract:

1. Leave in place storm water pollution prevention controls needed for post-construction storm water management and remove those that are not needed as determined by the District. Thereafter, left-in-place controls will be maintained by the District.

2. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certifications and related documents to the District. Post-construction storm water operation and management plan as mentioned in the compliance certifications are considered to be in place at the end of the Construction Contract.

3.03 MONITORING

A. Conduct examination of storm water pollution prevention controls monthly, as well as before and after each storm. Prepare and maintain, at the jobsite, a log of each inspection using Site Monitoring Report forms.

3.04 LIABILITIES AND PENALTIES

A. Review of the SWPPP and inspection log by the District shall not relieve the Contractor from liabilities arising from non-compliance of storm water pollution regulations.

B. Payment of penalties for non-compliance by the Contractor shall be the sole responsibility of the Contractor and will not be reimbursed by the District.

3.05 CHANGE OF INFORMATION

A. Submit to the District a completed NOI for change of information (Construction Site Information and Material Handling/Management Practices).

3.06 ATTACHMENTS

A. Site Monitoring Report.

B. Compliance Certification.

END OF SECTION

_____ LVUSD Project Number	**GENERAL CONSTRUCTION ACTIVITY STORM WATER PERMIT** **COMPLIANCE**	STATE OF CALIFORNIA STATE WATER BOARD WDID NO._____

School Name: _____ _____
Project Description: Contract Number

ANNUAL CERTIFICATION

I certify under penalty of the law that the ongoing construction project has met the following conditions: All elements of the Storm Water Pollution Prevention Plan are in place; construction materials and equipment maintenance waste have been disposed of properly; and the site is in compliance with all local storm water management requirements including erosion/sediment control requirements and the appropriate use permits have been obtained.

Contractor: _____

Print Name: _____ Title: _____

Signature: _____ Date: _____

_____

END OF CONTRACT CERTIFICATION

I certify under penalty of the law that the construction project has been completed and the following conditions have been met:: All elements of the Storm Water Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; the site is in compliance with all local storm water management requirements including erosion/sediment control requirements and the appropriate use permits have been obtained; and a post-construction storm water operation and management plan is in place.

Contractor: _____

Print Name: _____ Title: _____

Signature: _____ Date: _____

_____ LVUSD Project Number	**STORM WATER POLLUTION PREVENTION SITE MONITORING REPORT**	STATE OF CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

School Name: _____ _____

Project Description: Contract Number

I. Type of Examination: (Use one form for each type of examination)

☐ Prior to Anticipated Storm Event ☐ After Actual Storm Event ☐ Monthly

Date Examined: _____

II. Check the response for each SWPPP question below:

		YES	NO
1.	Do you have an approved Storm Water Pollution Prevention Plan (SWPPP) and a BMP Handbook on site?	☐	☐
2.	Does your SWPPP incorporate an up-to-date erosion control plan?	☐	☐
3.	Is the erosion control installed per plan?	☐	☐
4.	If the job is at a stage where the erosion control plan can not be constructed, is the erosion control at the Maximum Extent Practicable for the stage you are in?	☐	☐
5.	Did you observe the presence of any floating materials such as oil, grease, pieces of wood, paper, etc., odor, toxics, and/ or sediments?	☐	☐
6.	If yes, what is it that you observed? _____		

III.Check the status of the following items as observed.

	SWPPP Items	Acceptable	Not Acceptable	Repairs Required	Date Repairs Completed
1.	Desilters (Cleaned)	☐ --	☐ --	☐	
2.	Water Quality Basin	☐ --	☐ --	☐	
3.	Silt Fences	☐ --	☐ --	☐	
4.	Strawbales/Checkdams/Sandbags	☐ --	☐ --	☐	
5.	Berms and Dikes	☐ --	☐ --	☐	
6.	Sand/Gravel Inlet	☐ --	☐ --	☐	
7.	Slope Protection - Polymer and Mulch	☐ --	☐ --	☐	
8.	Vegetation/Revegetation	☐ --	☐ --	☐	
9.	Dust Control	☐ --	☐ --	☐	
10.	Surface Erosion	☐ --	☐ --	☐	
11.	Slope Instability	☐ --	☐ --	☐	
12.	Storage	☐ --	☐ --	☐	
13.	Disposal	☐ --	☐ --	☐	
14.	Spills	☐ --	☐ --	☐	
15.	Clean-up	☐ --	☐ --	☐	
16.		☐ --	☐ --	☐	
17.		☐ --	☐ --	☐	

IV.Describe any problems or required repairs checked above and the necessary actions needed:

Item	Description of Problem or Required Repair	Action Needed

Examination Performed by Contractor: _____ _____

By (Print Name, Title and Sign) Date

Verified by Construction Inspector: _____ _____

Print Name, Title and Sign Date

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SECTION 01 73 00

FIELD ENGINEERING

PART 1-GENERAL

1.01 REQUIREMENTS INCLUDED

A. Surveying and Field Engineering Services.

1.02 QUALITY CONTROL

A. Land Surveyor: Registered in the State of California and acceptable to the District's Architect, Inspector, and/or Project Manager.

1.03 LINES AND GRADES

A. The Contractor shall provide all construction survey work required for the accurate location of the work. Horizontal and vertical control for the work shall be from the project reference marks as shown on the Drawings. In all questions arising as to the proper location of the work, the District's A&E team's, and the Inspector's decision shall be final.

B. The Contractor shall verify final configuration of the project during demolition work. Minor adjustments of the work to accommodate existing field conditions shall be the responsibility of the Contractor.

C. Replace, at no increase in Contract Sum, control points which may be lost or destroyed; base requirements on original survey control.

PART 2- PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify locations of survey control points prior to starting work. Promptly notify District Architect and Inspector of any discrepancies discovered.

3.2 SURVEY REFERENCE POINTS

A. Protect survey control points prior to starting site work; preserve permanent reference points during construction. Make no changes without prior written notice to the Architect and Inspector.

B. Promptly report to the Architect and the Inspector the loss or destruction of any reference point or relocation required because of changes in grades or other reasons. Replace dislocated survey points based on original survey control.

3.3 SURVEY REQUIREMENTS

A. Establish a minimum of three (3) permanent bench marks on site, referenced to establish control points. Record locations, with horizontal and vertical data, on Project Record Documents.

B. Establish lines and levels, locate and lay out by instrumentation and similar appropriate means:

1. Site improvements, including pavements; stakes for grading, fill and topsoil placement; and utility locations, slopes and invert elevations.

2. Grid or axis for structures.

3. Building foundation, column locations, and ground floor elevations.

4. Controlling lines and levels required for mechanical and electrical work.

5. Verify layouts as Work proceeds to assure compliance with required lines, levels and tolerances.

C. Periodically certify layouts by same means, with same approvals by the Architect and Inspector.

3.4 RECORDS

A. Maintain a complete and accurate log of all control and survey Work as it progresses.

B. On completion of foundation walls and major site improvement, including underground utilities, prepare a certified survey showing all dimensions, locations, angles, and elevations of construction to the Architect and Inspector for review and approval of the final survey for the Project record.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for cutting and patching.

1.02 RELATED SECTIONS

A. Section 01 31 00: Project Coordination

B. Section 01 31 50: Project Meetings

C. Section 01 33 00: Submittals

D. Section 01 32 00: Schedule and Reports

E. Section 01 43 00: Testing and Laboratory Services

F. Section 01 78 00: Warranties & Bonds

PART 2 - PRODUCTS (Not applicable)

PART 3 - EXECUTION

3.01 SUBMITTALS

A. The word “cutting” as used in the Contract Documents includes, but is not limited to, cutting, drilling, chopping, and other similar operations and the word “patching” includes, but is not limited to, patching, rebuilding, reinforcing, repairing, refurbishing, restoring, replacing, or other similar operations.

B. Cutting and Patching Proposal: CONTRACTOR shall submit a proposal describing procedures well in advance of the time cutting and patching will be performed if the Contract Documents requires approval of these procedures before proceeding. The Contractor shall be responsible for locating existing utilities within the Limits of Work, whether shown or not, prior to any excavation. Contractor shall protect in place all utilities not identified to be removed, relocated or abandoned. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required. Denote how it will be performed and indicate why it cannot be avoided.

2. Describe anticipated results in terms of changes to existing construction. Include changes to structural elements and operating components as well as changes in the building’s appearance or other significant visual elements.

3. List products to be used and firms or entities that will perform this Work.

4. Indicate dates when cutting and patching will be performed.

5. Utilities: List utilities that cutting and patching operations will disturb or affect. List utilities to be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

7. Review by ARCHITECT/Engineer and DSA INSPECTOR prior to proceeding with cutting and patching does not waive ARCHITECT/Engineer right to later require complete removal and replacement of defective Work.

3.02 QUALITY ASSURANCE

A. Requirements for structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

1. Obtain approval from ARCHITECT/Engineer and DSA Inspector of the cutting and patching proposal before cutting and patching the following structural elements:

a. Foundation construction

b. Bearing and retaining walls

c. Structural concrete

d. Structural steel

e. Lintels

f. Timber and primary wood framing

g. Miscellaneous structural metals

h. Equipment supports

i. Piping, ductwork, vessels, and equipment

j. Structural systems of special construction in Division 13 Sections.

B. Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safely.

1. Obtain review of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

a. Primary operational systems and equipment

b. Air or smoke barriers

c. Water, moisture, or vapor barriers

d. Membranes and flashings

e. Fire protection systems

f. Noise and vibration control elements and systems

g. Control systems

h. Communication and/or data systems

i. Electrical wiring systems

j. Operating systems of special construction in Division 13 Sections

C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the opinion of ARCHITECT/Engineer/District, or DSA Inspector reduce the building's aesthetic qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually satisfactory manner.

1. If possible, retain the original installer or fabricator to cut and patch the exposed Work listed below. If it is impossible to engage the original installer or fabricator, engage another recognized experienced and specialized firm.

a. Firestopping

b. Acoustical ceilings

c. Acoustical panels

d. Carpeting

e. HVAC enclosures, cabinets, or covers

f. Ceramic and quarry tile

g. Gypsum board

h. Masonry (exterior and interior where exposed)

i. Tack boards

j. Casework

k. Finish carpentry

3.03 WARRANTY

A. Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

3.04 INSPECTION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

1. Before proceeding, meet at the Project site with District Inspector, District Project Manager and District Maintenance Supervisors and all contractors involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding. ENSURE THAT ALL AVAILABLE AS-BUILT DRAWINGS ARE PULLED AND REVIEWED PRIOR TO ANY CUTTING.

3.05 PREPARATION

A. Temporary support: Provide adequate temporary support of existing improvements or Work to be cut, with prior approval by the Structural Engineer and/or DSA Inspector.

B. Protection: Protect existing improvements and Work during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of existing improvements or Work that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Where the Work requires sandblasting of existing surfaces in order to receive new materials secured by cementitious, adhesive or chemical bond, completely remove existing finishes, stains, oil, grease, bitumen, mastic and adhesives or other substances deleterious to the new bonding and/or fastening of new Work. Utilize wet sand blasting for interior surfaces and for exterior surfaces where necessary to prevent objectionable production of dust.

3.06 PERFORMANCE

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay. Carefully remove existing Work to be salvaged and/or reinstalled. Protect and store for reuse into the Work. Verify compatibility and suitability of existing substrates before starting the Work.

B. Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining Work. Where possible, review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine, such as a carborundum saw or a diamond-core drill. Saw cut reinforcing bars and paint ends with bituminous paint except where bonded into new concrete or masonry.

4. Comply with requirements of applicable Division 2 Sections where cutting and patching requires excavating, backfill, and/or recompaction.

5. Woodwork: Cut and or remove to a panel or joint line.

6. Sheet Metal: Remove back to joint, lap, or connection. Secure loose or unfastened ends or edges and seal watertight.

7. Glass: Remove cracked, broken, or damaged glass and clean rebates and stops of setting materials.

8. Plaster: Cut back to sound plaster on straight lines, and back bevel edges of remaining plaster. Trim existing lath and prepare for new lath.

9. Gypsum Wallboard: Cut back on straight lines to undamaged surfaces with at least two opposite cut edges centered on supports.

10. Acoustical ceilings: Remove hanger wires and related appurtenances where ceilings are not scheduled to be installed.

11. Tile: Cut back to sound tile and backing on joint lines.

12. Flooring: Completely remove flooring and clean backing of prior adhesive. Carefully remove wood flooring for patching and repairing of existing wood flooring scheduled to remain.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with required tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation. Verify conditions of existing substrates prior to executing Work.

2. Restore exposed finishes of patched areas and extend finish restoration into retaining adjoining construction in a manner that will eliminate all evidence of patching and refinishing.

3. Concrete: Maintain cut edges in a moist condition for twenty four (24) hours prior to the placement of new concrete. In lieu of this an epoxy adhesive may be provided. Finish placed concrete to match existing unless noted otherwise. Concrete shall have a minimum compressive strength of 3,000 psi where installed to repair and/or match existing improvements, unless noted otherwise, and approved by the Structural Engineer, in conjunction with review by the DSA Inspector.

4. Metal Fabrications: Items to remain exposed shall have their edges cut and ground smooth and rounded.

5. Sheet Metal: Replace removed or damaged sheet metal items as required for new Work.

6. Glass: Install matching glass and re-seal exterior window assemblies.

7. Lath and Plaster: Install new lath materials to match existing and fasten to supports at 6” centers. Provide a 6” lap where new lath to adjoins existing lath. Fasten new lath as required for new Work. Restore paper backings as required. Apply a bonding agent on cut edges of existing plaster. Apply three coat plaster of the type, thickness, finish, texture, and color to match existing.

8. Gypsum Wallboard: Fasten cut edges of wallboard. Install patches with at least two opposite edges centered on supports and secure at 6” centers. Tape and finish joints and fastener heads. Patching shall be non-apparent when painted or finished.

9. Acoustical Ceilings: Comply with the requirements for new Work specified in related sections of the Contract Documents.

10. Resilient Flooring: Completely remove flooring and prepare substrate for new material.

11. Painting: Prepare areas to be patched, patch and paint as specified under related sections of the Contract Documents.

3.06 CLEANING

A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged coverings to their original condition.

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.01 SECTION INCLUDES.

A. Maintain premises and adjacent public and private properties free from accumulations of waste, debris, and rubbish, caused by operations during the project.

B. At completion of Work, remove waste materials rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces; leave project clean and ready for occupancy.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Use only cleaning materials recommended by the manufacturer of surface to be cleaned.

B. Use cleaning materials only on proper surfaces recommended by the manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION:

A. Execute daily cleaning plans from each trade to ensure that buildings, grounds, and public and private properties are maintained free from accumulations of waste materials, rubbish and trash on a daily basis.

B. Wet down dry materials and rubbish to prevent blowing dust and debris on and from the construction work.

C. Daily, during progress of work, clean construction site and utilized public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site steel dump containers and appropriately sized trash containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off the District's property.

F. Vacuum clean and wet wipe interior building walls, floors, doors, windows, and hardware in preparation for and when ready to receive finish preparation and painting. Continue vacuum cleaning on an as-needed basis until building is ready final inspection by the Architect, Inspector, and Project Manager and determined to be ready for substantial completion and occupancy.

G. Handle materials in a controlled manner to minimize any unnecessary waste or debris emanating from the construction areas. Do not drop or throw materials from heights: rather, a closed chute shall be used, to minimize unnecessary dust, waste or debris from the construction area.

H. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not migrate into new equipment or furniture, or onto wet, newly painted surfaces.

3.02 FINAL CLEANING:

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. Exterior: Clean surfaces of the construction and site including, but not limited to, fixtures, walls, soffits, floors, hardware, roofs, window and opening ledges and sills, horizontal projections, steps and platforms, walkways, rails and all like surfaces, and adjoining private and public property to the extent soiled by the Contractor's operations.

C. Interior: Leave all horizontal and vertical surfaces in vacuum cleaned, wet-wiped condition with all dust, dirt, stains, hand marks, paint spots, droppings, and other blemishes and defects completely removed, and conform to the following requirements:

1. Hard Floors: Freshly administer specified product sealants, and Wet mop/wash and dry, concrete, portland cement flooring, tile, elastomeric, epoxy, refinished and colored concrete, and similar hard floor surfaces free of dust, streaks or stains.

2. Resilient Tile Flooring: Freshly wax and buff as specified in Section 09 65 19.

3. Resilient Bases: Clean off adhesive smears and wipe clean with wet-wipe methods.

4. Unpainted and Painted Surfaces: Clean of dust, lint, streaks or stains, utilizing wet-wipe methods as necessary.

5. Tile Walls: Clean and polish per manufacturer's specifications.

6. Hardware and Metal Surfaces: Clean and polish all exposed surfaces using non-corrosive and nonabrasive materials.

7. Glass: Wash and polish both sides, and leave free of dirt, spots, streaks, and labels. Clean and polish mirrors.

8. Ceilings: Clean and free of stains, hand marks, and defacing.

9. Replace air conditioning filters as specified in Mechanical Specifications.

10. Clean ducts, blowers and coils, if air conditioning units were operated without filters during construction, and after final inspection.

11. Lighting fixtures: Replace lamps and clean fixtures and lenses if fixtures or lamps are dirty or have smudges or dust.

12. Fixtures and Equipment: Clean and polish mechanical and electrical fixtures and like items. Leave lighting fixtures free of dust, dirt, stains or waste material. Clean and service equipment and machinery, leaving ready for use.

13. Surfaces Not Mentioned: Clean according to the intent of this Section and as required for Architect's approval.

D. Contaminated Earth: Final clean up operation includes the removal and disposal of earth that is contaminated or unsuitable for support of plant life in planting areas, and filling the resulting excavations with suitable soil as directed and approved by the Architect, Inspector, and/or Project Manager.

Contaminated areas include those used for disposal of waste concrete, mortar, plaster, masonry, paints, and similar materials, and areas in which washing out of concrete and plaster mixers or washing of tools and like cleaning operations have been performed, and all areas and adjacent areas that have been oiled, paved, or chemically treated.

Do not dispose of waste, oil, solvents, paints, solutions, or like penetrating material by depositing or burying on School property; dispose of such material in a lawful manner.

END OF SECTION

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparation and implementation, including reporting and documentation, of a Waste Management Plan for reusing, recycling, salvage or disposal of non-hazardous waste materials generated during demolition and/or new construction (Construction & Demolition (C&D) Waste), to foster material recovery and re-use and to minimize disposal in land fills.

B. Related Sections

1. Section 01 33 00: Submittals.
2. Section 01 50 00: Construction Facilities and Temporary Controls.
3. Section 01 77 00: Project Closeout.

1.2 REFERENCES

A. California Integrated Waste Management Act of 1989 (AB 939).

B. California Code of Regulations Title 14, Section 18700 et seq.

C. Collaborative for High-Performance Schools (CHPS).

1.3 SYSTEM DESCRIPTION

A. Collection and separation of all C&D waste materials generated on-site, reuse or recycling on-site, transportation to approved recyclers or reuse organizations, or transportation to legally designated landfills, for the purpose of recycling salvaging and/or reusing a minimum of 90% of the C&D waste generated.

1.4 SUBMITTALS

A. C&D Waste Management Plan (Exhibit 1): Within 10 calendar days after the Notice to Proceed and prior to any waste removal, submit the following to the OAR for review and approval. Update quarterly. Include:

1. Materials to be recycled, reused, or salvaged, either onsite or offsite.
2. Identification of licensed waste haulers and processors of recyclable materials. Permit or license and location of Project waste-disposal operations.
3. Estimates of C&D waste quantity (in tons) by type of material. (If waste is measured by volume, give density for conversion to weight in tons.) Provide total tons of waste generated as well as tons of recycled waste and calculate the recycled percentage.

4. Procedures for recycling/ reuse program.
5. Site Plan for placement of waste containers.
6. Documentation of recycling, salvaging and reusing material costs, and specific plans for recycling corrugated cardboard, metals, concrete brick, asphalt, beverage containers, clean dimensional wood, plastic, glass, gypsum board and carpeting.

B. C&D Waste Management Monthly Progress Report (Exhibit 2): Summary of waste generated by Project, monthly with Application for Payment. Include:

1. Firms accepting the recovered or waste materials.
2. Type and location of accepting facilities (landfill, recovery facility, used materials yard, etc.). If materials are reused or recycled on the Project site, location should be designated as “on-site reuse / recycling”.
3. Type of materials and net weight (tons) of each.
4. Value of the materials or disposal fee paid.
5. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.

C. C&D Waste Management Final Compliance Report: Final update of Waste Management Plan to provide summary of total waste generated by project, as well as the total recycled waste (recycled rate (%) = (recycled waste in tons)/(recycled waste in tons + disposed waste in tons) x 100. Recycled waste must be verified with receipts. See also Part 3.2 Attachments herein.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 IMPLEMENTATION

A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or reused, or disposed in landfills.

B. Designate an on-site person to be responsible for instructing workers and overseeing the sorting and recording of waste/ recyclable materials.

C. Include waste management and recycling in worker orientation and as an agenda item for regular Project meetings.

D. Recyclable and waste bin areas shall be limited to areas approved on the Waste Management Plan. Keep recycling and waste bins neat and clearly marked to avoid contamination of materials.

3. 2 ATTACHMENTS

A. Exhibit 1: Waste Management Plan

B. Exhibit 2: Waste Management Monthly Progress Report.

EXHIBIT 1

WASTE MANAGEMENT PLAN
CONSTRUCTION/ MAINTENANCE/ALTERATION & DEMOLITION PROJECTS

PROJECT NAME: «PROJECT TITLE» «CONTRACT TITLE»
PROJECT NO: «Project Number»
NAME OF COMPANY:
CONTACT PERSON:
TELEPHONE:
PROJECT SITE LOCATION:
PROJECT TYPE: ☐ NEW CONSTRUCTION ☐ DEMOLITION
☐ MAINTENANCE/ALTERATION PROJECTS
PROJECT SIZE (SQ. FT.):
DATE & ESTIMATED PERIOD

(1) Material Type	(2) Tons Estimated Recycle	(3) Tons Estimated Reuse	(4) Tons Estimated Salvage	(5) Tons Estimated Landfill	(6) Proposed Disposal or Recycling Facility (e.g., Onsite, Name of Facility)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					=

Signature	Title	Date

Column 1	"Material Types" – Enter type of materials targeted for recycling, reuse, and/or salvage, either on- or off-site, and include a category for waste materials requiring disposal.
Columns 2 thru 4	"Estimated Generation" - Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.
Column 5	"Estimated Landfill" - Enter quantities (tons) of materials to be disposed in landfill.
Column 4	"Disposal Location" - Enter end-destination of recycled, salvaged, and disposed materials.
General :	(1) Attach proposed Recycling & Waste Bin Location Plan.
	(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 2

WASTE MANAGEMENT PROGRESS REPORT
CONSTRUCTION/ MAINTENANCE/ALTERATION & DEMOLITION PROJECTS

PROJECT NAME: «PROJECT TITLE» «CONTRACT TITLE»
PROJECT NO: «Project Number»
NAME OF COMPANY:
CONTACT PERSON:
TELEPHONE:
PROJECT SITE LOCATION:
PROJECT TYPE: ☐ NEW CONSTRUCTION ☐ DEMOLITION
☐ MAINTENANCE/ALTERATION PROJECTS
PROJECT SIZE (SQ. FT.):
PERIOD to

(1) Material Type	(2) Tons Actual Recycle	(3) Tons Actual Reuse	(4) Tons Actual Salvage	(5) Tons Actual Landfill	(6) Disposal or Recycling Facility (e.g., Onsite, Name of Facility)
Total					
Diversion Rate: Columns [(2)+(3)+(4)] / [(2)+(3)+(4)+(5)]					=

Signature	Title	Date

Column 1	"Material Types" – Enter type of materials targeted for recycling, reuse, and/or salvage, either on- or off-site, and include a category for waste materials requiring disposal.
Columns 2 thru 4	"Estimated Generation" - Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.
Column 5	"Estimated Landfill" - Enter quantities (tons) of materials disposed.
Column 4	"Disposal Location" - Enter end-destination of recycled, salvaged, and disposed materials.
General :	(1) Attach proposed Recycling & Waste Bin Location Plan.
	(2) Attach name and contact data for each recycling or disposal destination to be used.

END OF SECTION

SECTION 01 77 00

CONTRACT CLOSE-OUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Procedures for closing-out Project.

1.02 RELATED SECTIONS:

A. Closeout Submittals: See Respective Specification Sections.

1.03 GENERAL:

A. As a prerequisite for final payment release, Contractor shall complete the work of this Section.

B. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.04 PRE-FINAL INSPECTION; SUBSTANTIAL COMPLETION:

A. Pre-final Inspection:

1. Upon "substantial completion" of the Work AS AGREED TO BY Contractor, Architect/Engineer, DSA Inspector and District Project Manager, Contractor shall notify Architect/Engineer, and DSA Inspector and request a "pre-final inspection" of the Work.

2. If Architect/Engineer, Inspector, and Project Manger concur that work of the contract project/phase is "substantially complete", he will review and list any items that need to be corrected on a punch list. List will be amended as required to include items on the correction or punch list subsequently observed.

B. Substantial Completion Defined: "Substantial Completion" of the Work is the status, as approved by the Architect/Engineer when construction is sufficiently complete, in accordance with the Contract Documents, so the District/Owner can occupy or utilize the Work for the use for which it is intended.

1.05 FINAL INSPECTION:

A. Reference: See Supplementary Conditions.

B. Final Inspection: When Contractor has complied with above Article at the end of the final phase, Architect/Engineer and DSA Inspector and Project Manager will review the Work and list any items that are not completed or need to be corrected.

C. Contractor shall complete and/or correct the Work in a timely manner as outlined in the contract documents.

1.06 GUARANTEES:

A. General: Contractor shall guarantee in writing to District/Owner that:

"Contractor will repair or replace any or all of such work, together with any other adjacent work which may be displaced in connection with such replacement, that may prove to be defective

in workmanship or material within a period of (stated below) years from the date of acceptance of the above mentioned structure by the Glendale Unified School District, ordinary wear and tear, and unusual abuse or neglect excepted."

B. Format: Contractor shall submit guarantees typed in the format indicated in "Guarantee Form".

C. Number of Copies: Submit in triplicate (3) to Architect/Engineer with one electronic pdf.

D. Required Guarantees:

1. General: Submit all guarantees listed herein or required by various Spec. Sections.

2. General Guarantee:

a. By General Contractor; For the Entire Work: 1 Year.

3. Specific Guarantees:

	SPEC DIVISION	ITEM	TIME PERIOD
a.	Division 6	Custom Casework	2 Years
b.	Division 7	Single Ply Roofing	10 Years
		All Flashing & Sheet Metal, in connection with roof coverings	5 Years
		All Joint Sealants	5 Years
		Damp proofing	2 Years
c.	Division 8	Hollow Metal Doors & Frames	2 Years
		Wood Doors	Lifetime
d.	Division 9	Acoustical Ceiling Systems	2 Years
e.	Division 10	Porcelain Enamel Liquid Marker Board Surfaces	Lifetime
		Toilet Compartments	Lifetime
		Operable Walls	3 Years
		Toilet Accessories	1 Years
f.	Division 11	Equipment	
		Projector Screen	1 Years
		Laboratory Equipment and Cabinets	Lifetime
g.	Division 12	Furnishings	
		Vertical Blinds	Lifetime
h.	Division 14	Hydraulic Elevator	1 Year
		Wheelchair Lift	1 Year
I.	Division 15	Plumbing	1 Year
		HVAC Systems	1 Year
		Temperature Controls for HVAC Systems	1 Year
j.	Division 16	All Electrical Work	1 Year

1.07 WARRANTIES:

A. General: Comply with Section 01780. Submit all warranties required by various Specification Sections.

1.08 CERTIFICATES:

A. General: Submit in triplicate (3) all certificates required by various Specification Sections or listed herein, notarized as required.

B. Certificates:

1. Division 8: Finish Hardware installation acceptance.

2. Division 28: Fire Alarm System.

1.09 OPERATION AND MAINTENANCE DATA:

A. General: Submit all manuals required by various Specification Sections or listed herein; three (3) copies each, and one electronic pdf. Provide durable binders, no less than 8-1/2" x 11" in size and provide the following information:

1. Identification on, or readable through, the front cover stating general nature of the manual.

2. Neatly typewritten index at the front of the Manual, furnishing immediate information as to location in the Manual of all data or equipment included.

3. Complete instructions regarding operation and maintenance of all equipment included.

4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name and address of nearest vendor of parts.

5. Copy of all Guarantees and Warranties issued.

6. Copy of the approved Shop Drawings with all data concerning changes made during construction.

B. Extraneous data: Where contents of Manuals include Manufacturers' catalog pages, clearly indicate the precise items included in this installation by clouding, or highlighting, and delete, all manufacturers' data with which this installation is not concerned.

1.10 RECORD DRAWINGS:

A. Procedures:

1. Promptly following contract award, General Contractor shall secure from the District one complete set of Drawings. Identify the set as "Record."

2. Timing of Entries: Make entries within 24 hours after receipt of information on any changes by Contractor or Sub Contractors.

3. Contractor shall be responsible for maintaining and recording the changes on the set, and by affixing any related RFI, COR, and/or ASI applicable to the changes.

4. Do not use the "Record" set for any purpose except entry of new data and for review by the Architect. Maintain separate job sets for subcontractors and workers daily use.

5. Maintain the "Record" set at the job site where designated by the Architect/Engineer, in conjunction with the DSA Inspector.

6. Use all means necessary to protect the "Record" set from deterioration, loss or damage until completion of the work.

7. Making entries on Drawings: Using an erasable colored pencil, other than blue or black, not ink or indelible pencil, and clearly describe the change by note and by graphic line as required. Date all entries. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

    a. Changes due to approved change orders may be indicated by referencing the change order number and scope of change in lieu of revising the Drawings.

    b. The location and depth below finish grade or above ceilings and attic spaces of utilities shall be fully dimensioned and indicated on Drawings. Dimensions shall be taken to building lines or permanent landmarks.

8. The architect's approval of the current status of the "Record" drawings will be a prerequisite to the Architect/Engineer's and DSA Inspector's approval of requests for progress payments and request for final payment release.

    a. Progress approvals: Prior to submitting each request for progress payments, secure the District DSA Inspector's approval of the status of the "Record" Drawings.

    b. Prior to submitting request for final payment and final inspection, General Contractor shall submit the "Record Drawing" set to the District DSA Inspector, with transmittal letter, in duplicate, for approval and further processing through the Architect/Engineers for their approval and acceptance, and delivery to the District.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 78 00

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SUBMITTAL REQUIREMENTS:

A. Assemble Warranties, Bonds, and Service and Maintenance Contract, executed by each of the respective Manufacturers, Suppliers, and Subcontractors, and submit to the Architect/Engineer for review and approval before Final Payment will be approved and released.

B Number of original signed copies required: Three (3) each and one electronic pdf.

C. Table of Contents Neatly typed in orderly sequence.

D. Provide complete information for each item:

1. Product or work Item.

2. Firm, with name of principal, address and telephone number.

3. Beginning date of Warranty, Bond, or Service and Maintenance Contract.

4. Duration of Warranty, Bond of Service, and Maintenance Contract.

5. Provide the following information for District/Owner's Personnel:

a) Procedure in case of failure or malfunction.

b) Instances which affect Warranty or Bond validity.

6. Contractor, name of responsible principal, address, telephone number and email address.

1.02 SUBMITTAL FORM:

A. Punch sheets for standard 3-ring binder.

B. Size: 8-1/2 x 11 inches.

C. Fold larger sheets to fit into binder.

D. Cover: Identify each packet with typed or printed title 'WARRANTIES AND BONDS" 1st:

1. Title of Project.

2. Name of Contractor.

PART 2 – PRODUCTS – NOT USED

PART 3 – EXECUTION – NOT USED

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA-TRAINING OF OWNER'S PERSONNEL

PART 1 - GENERAL

1.01 SECTION INCLUDES.

A. Assembly and submission of operating and maintenance data and manuals.

B. Submission of preliminary draft of final data and manuals.

C. Instruction of Owner’s personnel in operation, adjustment and maintenance of products, equipment and systems.

1.02 MANUALS:

A. General: Where manuals are required to be submitted covering items included in this Work prepare all such manuals in durable plastic 3-ring binders no less than 8-1/2 by 11 inches in size and with at least the following:

1. Identification on, or readable through, the front cover stating general nature of the manual;

2. Neatly typewritten index near the front of the manual, furnishing immediate information as to location in the manual of all data;

3. Copy of all guarantees and warrantees issued.

B. Maintenance and operation instructions:

1. Procure or prepare and include in manuals, operating and/or maintenance instruction for all equipment and/or materials that will require any adjustment, servicing, or attention for its proper operation or use.

2. These instructions shall set forth all of the information necessary for the District to operate and make full and efficient use and perform such maintenance and servicing, as would ordinarily be done by the District or maintenance personnel.

3. Write instructions in simple, non-technical language when possible, with sufficient diagrams and explanation where necessary to be readily understandable by average layman. Possible hazards shall be particularly pointed out with instruction cautioning against mistakes that might result in damage or danger to equipment, building, or personnel.

C. Extraneous data: Where contents of manuals include manufacturer’s catalog pages, clearly indicate the precise items included in this installation and delete or otherwise clearly indicate all manufacturer’s data with which this installation is not concerned.

1.03 MANUAL CONTENT:

A. Neatly typewritten table of contents for each volume, arrange in systematic order.

B. List:

1. Contractor, name of responsible principal, address, telephone number, and email address of the company contact.

2. Each product including name, telephone number, and email address of:

   a. Subcontractor or installer.

   b. Recommended maintenance contractor.

   c. Local source for replacement parts (within 50 mile radius of site).

3. Product name and other identifying symbols set forth in Contract Documents.

4. Product Data:

   a. Include only those sheets which are pertinent to specific product.

   b. Annotate each sheet to:

      1) Clearly identify specific product or part installed.

      2) Clearly identify data applicable to installation.

      3) Delete references to inapplicable data.

5. Drawings:

   a. Supplement product data with drawings where necessary to clearly illustrate:

      1) Relations of component parts.

      2) Control and flow diagrams.

   b. Do not use “Project Record Documents” as maintenance drawings.

6. Written Text:

   a. Provide where necessary to supplement Product Data and drawings.

   b. Organize in consistent format under separate headings for different procedures.

   c. Provide logical sequence of instruction for each procedure.

7. Warranties, Bonds, and Maintenance Contracts:

   a. Provide copies of each of the following:

      1) Proper procedures in event of failure.

      2) Instances which might affect validity of warranties, bonds, or contracts.

1.04 MANUAL FOR ARCHITECTURAL MATERIALS AND FINISHES:

A. Include the following manufacturer’s data:

1. Catalog number, size, composition.

2. Color and texture designations.

3. Required reordering information.

4. Recommend cleaning materials and methods.

5. Cautions against detrimental cleaning materials and methods.

6. Recommend cleaning and maintenance schedule.

B. Submit specified information for the following:

1. Finish Hardware: Section 08 71 00.

2. Visual Display Surfaces: Section 10 11 00.

3. Fire Extinguishers: Section 10 44 00.

4. Window Blinds: Section 12 21 00.

1.05 MANUAL FOR ROOFING MATERIALS

A. Include the following manufacturer's data:

1. Instructions for inspection, maintenance and repair.

1.06 MANUAL FOR MECHANICAL EQUIPMENT AND SYSTEMS

A. Include the following manufacturer's data:

1. Function, normal operating characteristics, and limiting conditions.

2. Performance curves, engineering data, and tests.

3. Complete nomenclature and commercial number of replaceable parts.

B. Operating procedures including:

1. Start-up, break-in routine, and normal operating instructions.

2. Regulations, control, stopping, shut-down, and emergency instructions.

3. Summer and winder operating instructions.

4. Special operating instructions.

C. Maintenance procedures including:

1. Routing operations.

2. Trouble shooting guide

3. Disassembly, repair, and reassemble.

4. Alignment, adjusting, and checking.

5. Servicing and lubricating schedule, including recommended lubricants.

D. Manufacturer's printed operating and maintenance instructions.

E. Control system operation sequences.

F. Parts list, illustrations, assembly drawings, and diagrams necessary for maintenance including:

1. Life expectancy of parts subject to wear.

2. Items recommended to be stocked as spare parts.

G. As-installed control systems diagrams.

H. Color-code legend, if any.

I. Valve tag number chart, with location and function of each valve, in typewritten format, clearly indicating location on a room, area, or building diagram in sufficient size to readily identify the item.

J. Submit specified information for the following; Mechanical equipment specified in the Mechanical Equipment schedules and Specifications.

1.07 MANUAL FOR ELECTRICAL EQUIPMENT AND SYSTEMS

A. Include the following manufacturer's data:

1. Description of unit and component parts including:

a. Function, normal operating characteristics and limiting conditions.

b. Performance curve, engineering data and tests.

c. Complete nomenclature and commercial number of replaceable parts.

2. Panel board circuit directories indicating:

a. Electrical service.

b. Controls.

c. Communications, if any.

3. As-installed wiring color-code legend, if any.

4. Operating procedures including:

a. Routine and normal operating instructions.

b. Sequences required.

c. Special operating instructions.

5. Maintenance procedures, including:

a. Routine operations.

b. Trouble-shooting guide.

c. Disassembly, repair, and reassembly.

d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. Parts list, including current prices, and recommended spare parts to be maintained in storage.

B. Submit specified information for the following:

1. Electrical equipment specified in Mechanical and Electrical Equipment Schedules and Specifications.

1.08 ADDITIONAL DATA

A. Prepare and include the following:

1. Additional data when need becomes apparent during instruction of District's personnel.

2. Additional data specified in other Sections of Specifications to be included.

1.09 SUBMITTAL SCHEDULE

A. Preliminary Draft:

1. Submit two copies of the proposed format, approximately fifteen (15) days before substantial completion to the Architect and Inspector and/or Project Manager for review and comments.

2. Architect and Inspector will review and return one copy with any comments.

B. Final Submittal:

1. Submit, in final form, one copy of complete data seven (7) days prior to final inspection. Copy will be returned with comments.

2. Submit four (4) copies in approved final form prior to final inspection and acceptance, and occupancy.

1.10 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to Substantial Completion, instruct District's personnel in necessary operation, adjustment, and maintenance of products, equipment and systems. District's personnel will consist of on-site School site personnel laypersons; Facility and Support Operations maintenance technicians; other District personnel. Instruction sessions (minimum of two) will be at a time and date convenient and pre-approved by the District Project Manager.

B. Operating and Maintenance Manuals, as well as knowledgeable installer(s) shall conduct the instruction, which SHALL BE VIDEOTAPED by the contractor, to constitute basis of instruction.

C. Review manual contents with District's personnel in detail to explain all aspects of operations and maintenance, and conduct hands-on demonstrations where appropriate, and conduct a question and answer session before the end of the training session. Training sessions will be as long as necessary to satisfy the personnel in attendance.

D. A listing of all personnel receiving instructions, complete with a sign-in sheet indicating the printed name, and the signature of those attending, dates and times of instruction, and pertinent data regarding the training specific equipment or system, shall be delivered to the Architect/Engineer/Inspector and/or Project Manager upon completion of instruction session(s).

E. The District's designated Facility and Support Operations (FASO) Representative will be instructed as to the proper operations of all environmental equipment and fire and life safety,

and security systems prior to Substantial Completion and Occupancy of a project phase or building, or building area. This instruction will be provided to the District's FASO and School Site personnel with the basic working knowledge of all equipment systems.

F. Contractor shall perform all testing, adjusting, etc., as outlined in the specifications and/or as recommended by the manufacturer.

G. **All HVAC equipment shall be operated a minimum of two (2) weeks or no less than 80 hours, with District specified MERV 7 or higher rating pleated filters, prior to Substantial Completion approval**.

PART 2 - PRODUCTS - NOT APPLICABLE

PART 3 - EXECUTION - NOT APPLICABLE

END OF SECTION

SECTION 01 91 00

COMMISSIONING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Commissioning consists of systematically documenting that specified components and systems have been installed and started up properly and then functionally tested to verify and document proper operation through all sequences of operation and conditions. In addition, training of the Owner's Operations Personnel will be verified and final project O&M Documents will be reviewed for completeness.

B. Related Sections:

1. Section 01 10 00 – "Summary of Work" for Commissioning Scope of Work.
2. Section 01 25 01 – "RFI" for procedures in preparing and submitting RFI's.
3. Section 01 32 00 – "Schedule and Reports" for progress Schedule, Construction Checklists and Progress Meeting requirements.
4. Section 01 33 00 – "Submittal Procedures" for requirements in preparing submittals.
5. Section 23 05 93 – "Testing, Adjusting and Balancing for HVAC" for Functional Performance Testing requirements.
6. Section 01 78 23 – "Operations and Maintenance Data Training" for requirements in scheduling, performing, documenting and evaluating the Training Sessions.
7. Section 01 77 00 – "Project Closeout" for requirements in preparation and submitting O&M Manuals and Drawings.

1.3 SYSTEMS TO BE COMMISSIONED

A. Mechanical Systems:

1. Heating Water Distribution
2. Chilled Water Distribution
3. Ventilation Systems

B. Plumbing Systems:

1. Domestic Water System

C. Electrical Systems:

1. Emergency Power System

2. Lighting Control System

1.4 DEFINITIONS

A. Basis of Design Document:

1. A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Authority:

1. An entity identified by the Owner who plans, schedules, and coordinates the Commissioning Team to implement the Commissioning Process.

C. Commissioning Plan:

1. Prepared and updated by the Commissioning Authority, the Commissioning Plan outlines the organization, schedule, allocation of resources, and documentation requirements of the Commissioning Process.

D. Commissioning Process:

1. A quality-focused process for enhancing the delivery of a project. The Process focuses on verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

2. Commissioning is typically abbreviated by "Cx". Commissioning and Cx have the exact same meaning and will be used interchangeably throughout the Contract documents.

E. Commissioning Team:

1. The individuals who through coordinated actions are responsible for implementing the Commissioning Process.

F. Construction Checklist:

1. Documents prepared by the Cx Authority and issued to the Contractor early in the Construction Phase. The purpose of the Checklist is to verify that appropriate components are on site, correctly installed and functional & ready for Performance Testing.

G. Corrective Issue Report:

1. A report generated by the Cx Authority during Verification Testing documenting deficiencies found during the testing procedures.

H. Functional Performance Testing:

1. The process by which specific documents, components, equipment, assemblies, systems, and interfaces among systems are confirmed to comply with the criteria described in the Owner's Project Requirements.

I. Owner's Project Requirements:

1. A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

1.5 COMMISSIONING TEAM

A. The Commissioning Team shall consist of a minimum of one (1) Representative for each of the following:

1. Owner.
2. Construction Manager.
3. Architect.
4. Engineer.
5. Contractor.
6. Commissioning Authority.

B. Each Commissioning Team Representative shall have at least five (5) years experience in construction administration along with a thorough understanding of construction project documentation procedures.

C. Each Cx Team Representative shall be familiar with ASHRAE Guideline 0 – The Commissioning Process.

PART 2 – PRODUCTS

2.1 VERIFICATION TESTING EQUIPMENT AND INSTRUMENTS

A. Contractor shall provide all tools, instruments, laptop computers, PDA,s, software programs and services required to perform system Verification Testing procedures. This includes providing the connection to systems to be tested, operation of the test equipment & instrumentation and generating test results as required.

PART 3 – EXECUTION

3.1 PROJECT SCHEDULE

A. The Commissioning Authority will provide to the Contractor a Schedule in CPM format identifying the Cx Activities for the Project. The Contractor shall incorporate these Cx Activities into the Master Project Schedule. The Cx Authority will review and update Cx Activities along with the Contractor's Master Schedule Update. Refer to Section 01 32 00 for procedures. Refer to a sample Cx Schedule at the end of this Section.

3.2 SUBMITTALS / SHOP DRAWINGS

A. The Commissioning Authority will review Product Submittals and Shop Drawings within the same review period as the Architect. The Cx Authority will review the Submittals and Shop Drawings for Cx Process related information and issue review comments directly to the Architect. Refer to Section 01 33 00 for procedures.

3.3 COMMISSIONING PROGRESS MEETINGS

A. The Commissioning Authority will conduct periodic Cx Progress Meetings throughout the construction phase of the project. Commissioning Team Members are required to attend these meetings.

B. The purpose of conducting Cx Progress Meetings separate from the regular job progress meetings is to focus on the Commissioning Process activities status, schedule and issues. Reference sample Cx Progress Meeting Agenda at the end of this Section.

C. Commissioning Team Members shall attend all Cx Progress Meetings.

D. At a minimum, the following meetings will be held:

1. Commissioning Kick-off Meeting – 1 Meeting (shortly after Pre-construction Meeting).
2. Commissioning Progress Meeting – (enter number) Meetings.
3. Testing / Training Meeting – 2 Meetings.

E. The Cx Progress Meetings shall be held at the Contractors Field Office.

F. The Cx Authority will conduct these meetings, record meeting minutes and distribute the minutes to all attendees with copies to appropriate entities.

3.4 QUALITY ASSURANCE TESTING

A. Contractor Field Testing:

1. The Commissioning Authority will receive one (1) copy of ALL Test Reports from the Contractor and assemble for record into the Commissioning Systems Manual.

B. Independent Testing:

1. The Commissioning Authority will receive one (1) copy of ALL Independent Testing Reports from the Contractor and assemble for record into the Commissioning Systems Manual.

C. Witnessing of Testing by Cx Authority:

1. Commissioning Authority shall be notified in advance of any Field or Independent Testing being performed. Refer to Section 01 40 00.

3.5 SUBSTANTIATING SYSTEM READINESS

A. The Commissioning Authority will prepare and issue to the Contractor a Construction Checklist Form for each system or major piece of equipment to be Commissioned. Reference sample Construction Checklist at the end of this Section.

B. The Contractor shall complete the Construction Checklist Forms, provided by the Cx Authority, as follows:

1. Complete Section 01 “Equipment Delivery” of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after equipment delivery to the site.
2. Complete Section 02 “Equipment Installation” of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment installation is completed.
3. Complete Section 03 “Equipment Start-up” of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment has been successfully started.
4. Complete Section 04 “Notification for Testing” of the Construction Checklist and forward to the Cx Authority within seven (7) calendar days after the equipment if fully operational and ready for Functional Performance Testing.

C. The Commissioning Authority will monitor and track the completion of the Construction Checklist Forms.

3.6 OPERATION & MAINTENANCE DATA

A. The Commissioning Process has special requirements on compiling and submitting Operation and Maintenance Data. O&M Data are required to be submitted to the Cx Authority immediately after receipt of the approved submittal from the Architect.

B. The Cx Authority will compile this information into the Project “Systems Manual” which will be used during Training Sessions.

C. Note that O&M Data must be submitted and approved BEFORE any Owner Training sessions will be allowed.

3.7 FUNCTIONAL PERFORMANCE TESTING

A. The Commissioning Authority will develop the Functional Performance Test Procedures to be used on the systems being Commissioned. The Test Procedures will be submitted to the Contractor in advance of scheduled Performance Testing to give the Contractor and Subcontractor's time to review the Procedures and make comments or suggest revisions. Reference sample Functional Performance Test Procedure Form at the end of this Section.

B. The Commissioning Authority will oversee and document results of all Functional Performance Testing Procedures required for equipment and systems to be Commissioned.

C. The Contractor is required to provide all testing instruments and all skilled labor required to conduct the Functional Test Procedures. The Commissioning Authority will attend all Functional Test Procedures and record all results of the Testing on the Functional Test Procedure Form.

3.8 CORRECTIVE ISSUE REPORT

A. The Commissioning Authority will document deficiencies discovered during Functional Performance Testing of systems on a Corrective Issue Report. The Cx Authority will then forward this form to the Contractor for action in correcting the deficiency.

B. When the deficiency has been corrected, the Contractor shall note action taken and return the Corrective Issue Report to the Commissioning Authority. Reference sample Corrective Issue Report at the end of this Section.

C. Corrective Issue Reports must be completed as a pre-requisite for Substantial Completion.

3.9 OWNER TRAINING

A. All training sessions shall be coordinated through the Owner and the Cx Authority. The Cx Authority will provide a Training Form template in the Commissioning Plan for the Contractor to complete. The Training Forms shall be used to schedule, perform and document the required training sessions.

B. After each Training Session is completed, the Cx Authority will issue an Evaluation Form to each of the Attendees. This feedback information will be provided to the Owner and Architect for review. Reference sample Evaluation Form at the end of this Section.

C. Refer to Section 01 78 23 for Owner training requirements.

COMMISSIONING CHECKLIST		
PROJECT NAME: Jefferson Elementary School		
MECHANICAL SYSTEMS - Heating, Ventilating, and Air Conditioning (HVAC)		
Main Items Included in Scope	**Required**	**Options Selected**
Vibration isolation	X	
Dampers	X	
Air distribution systems	X	
Exhaust air systems	X	
Trend logs	X	
Test and Balance verification	X	
Refrigeration equipment and controls	X	
BUILDING ENVELOPE		
Main Items Included in Scope	**Required**	**Options Selected**
Roofing system – water-proofing, insulation, roof membrane, rain and ice shield, pitch, coping, flashing, curbs for mechanical equipment, downspouts, drains, scuppers		☐
Exterior skin – curtainwall, storefront, masonry, brick / stone veneers, precast panels, metal panels, stucco / EIFS, siding		☐
Walls – vapor barriers, insulation, mortar nets, weeps, joints, sealants, masonry ties		☐
Slab on grade – vapor barriers, water-proofing, drainage, foundation drains		☐
Doors and windows – sealants, mechanical operation, sills, flashing, end dams, hardware		☐
Water tests, mockups, wind loads, thermal infiltration		☐
Special design features – dome, cornice, canopy, skylight, etc.		☐
ELECTRICAL LIGHTING SYSTEMS		
Main Items Included in Scope	**Required**	**Options Selected**
Lighting controls (scheduled activators and occupancy sensors)	**X**	**-**
Daylight dimming controls	**X**	**-**
Lighting - exterior		☐
Lighting - interior	**X**	**-**
Emergency lighting	**X**	**-**
NOTES:		

END OF SECTION

SECTION 02 41 16

DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnishing labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, or required for completion of the Work. Includes items such as the following:

1. Protection of existing improvements to remain.

2. Cleaning existing improvements to remain.

3. Disconnecting and capping utilities.

4. Removing debris, waste materials, and equipment.

5. Removal of items for performance of the Work.

6. Salvageable items to be retained by the Owner.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 1000 - Summary of the Project.

3. Section 01 5000 - Construction Facilities and Temporary Controls.

4. Section 01 7419 – Construction Waste Management.

5. Division 22 –- Plumbing.

6. Division 23 –- HVAC.

7. Division 26 –- Electrical.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating the extent of items and systems to be removed. Indicate items to be salvaged or items to be protected during demolition. Indicate locations of utility terminations and the extent of abandoned lines to be removed. Include details indicating methods and location of utility terminations.

1.03 QUALITY ASSURANCE

A. Perform the Work of this section by workers skilled in the demolition. Perform the Work of this section under direct superintendence at all times.

B. Prior to commencement of Work, schedule a walk through with the Owner's Representative, to confirm Owner property items have been removed from scheduled Work areas. Identify and mark remaining property items and schedule their removal.

C. Coordinate demolition for the correct sequence, limits, and methods. Schedule demolition Work to create least possible inconvenience to the public and facility operations.

D. Related Standard: ANSI/ASSE A10.6.

1.04 PROJECT CONDITIONS

A. Drawings may not indicate in detail all demolition Work to be performed. Examine existing conditions to determine the full extent of required demolition.

B. Repair damage to existing improvements or damage due to excessive demolition.

C. Provide all measures to avoid excessive damage from inadequate or improper means and methods, improper shoring, bracing or support.

D. If conditions are encountered that varies from those indicated, promptly notify the Architect for clarification before proceeding.

PART 2 - PRODUCTS

2.01 HANDLING OF MATERIALS

A. Items scheduled for salvage by the Owner shall be delivered to a location designated by the Owner's Representative. Items shall be cleaned, packaged and labeled for storage.

B. Items scheduled for reuse shall be stored on the Project site and protected from damage, theft and other deleterious conditions.

PART 3 - EXECUTION

3.01 GENERAL

A. Protection:

1. Do not commence demolition until safety partitions, barricades, warning signs and other forms of protection are installed. Refer to Section 01 5000 - Construction Facilities and Temporary Controls.

2. Provide safeguards, including warning signs, lights and barricades, for protection of workers, occupants, and the public.

B. If safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner's Representative.

3.02 DEMOLITION

A. Do not throw or drop materials. Furnish ramps or chutes as required by the Work.

B. Remove existing construction only to extent necessary for proper installation of Work and interfacing with existing construction. Cut back finished surfaces to straight, plumb or level lines as required for a smooth transition.

C. Where openings are cut oversize or in improper locations, replace or repair to required condition.

3.03 CUTTING EXISTING CONCRETE

A. Cutting of existing concrete shall be performed by skilled workers familiar with the requirements and space necessary for placing concrete. Perform concrete cutting with concrete cutting wheels and hand chisels. Do not damage concrete intended to remain.

B. Extent of cutting of structural concrete shall be as indicated on Drawings. Cutting of non-structural concrete shall be as indicated on Drawings or as reviewed by the Architect or structural engineer. Replace concrete demolished in excess of amounts indicated.

C. Prior to cutting or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.

3.04 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of the Work. Remove abandoned lines and cap unused portions of existing lines.

3.05 REMOVAL OF OTHER MATERIALS

A. Remove existing improvements not specifically indicated or required but necessary to perform Work. Cut to clean lines, allowing for installation of Work.

3.06 PATCHING

A. Patch or repair materials to remain when damaged by the performance of the Work of this section. Finish material and appearance of patch and/or repair Work shall match existing.

3.07 CLEANING

A. Clean existing materials to remain with appropriate tools and equipment.

B. Protect existing improvements during cleaning operations.

C. Debris shall be dampened by fog water spray prior to transporting by truck.

D. Debris pick-up area shall be kept broom-clean and shall be washed daily with clean water.

E. Remove waste and debris, other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where required. Continuously clean up and remove items as demolition Work progresses.

F. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Predemolition Photographs or Video: Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

1.5 CLOSEOUT SUBMITTALS

A. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.7 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Furnishing and equipment.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Hazardous Materials: Hazardous materials are present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.

F. Storage or sale of removed items or materials on-site is not permitted.

G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

C. Refrigerant: Remove refrigerant from mechanical equipment to be selectively demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to District.
4. Transport items to Owner's storage area designated by District.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain District's property, remove demolished materials from Project site and legally dispose of them in an approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

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SECTION 03 10 00

CONCRETE FORMS AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Formwork for cast-in-place concrete as indicated.
2. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

C. Related Sections:

1. Section 01 4200: Testing and Inspection
2. Section 03 2000: Concrete Reinforcement
3. Section 03 3000: Cast-In-Place Concrete
4. Section 03 3310: Lightweight Concrete Fill

1.2 SYSTEM DESCRIPTION

A. Regulatory Requirements: Except as otherwise specified herein, Work of this section shall be in accordance with 2019 CBC, Chapter 19A, Concrete, and ACI 318-14.

1.3 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of: forms, joints, embedded items, and accessories. Review and approval will not include form strength and adequacy.

B. Product Data: Submit manufacturer's Product Data for form materials and accessories.

C. Record Document: Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the Architect.

1.4 QUALITY ASSURANCE

A. Construction of Forms shall comply with the following as a minimum requirement:

1. ACI 347, “Recommended Practice for Concrete Formwork”
2. 2019 CBC Section 1906A.
3. Tolerances shall conform to those as specified in ACI 301, “Specifications for Structural Concrete for Buildings”, as applicable, unless exceeded by requirements of DSA or otherwise indicated or specified.
4. Plywood: Conform to tables for form design and strength in APA Form V 345.

B. Prior to construction of formwork for concrete beams and slabs above grade, Contractor shall conduct a meeting at the site to determine and define all camber, which may be required for the project. The Architect, Structural Engineer of record, Contractor and Contractor's formwork installer shall be in attendance at this meeting.

C. Mock-ups: Provide mock-ups for all exposed finishes; 100 square feet minimum size. Locate as required by the Architect, for review and approval prior to installation.

1.5 DELIVERY, STORAGE, AND HANDLING:

A. Deliver materials for forms in timely manner to ensure uninterrupted progress.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

PART 2 - PRODUCTS

2.1 GENERAL

A. Form materials may be reused during progress of the Work provided they are completely cleaned and reconditioned, recoated for each use, capable of producing formwork of required quality, and are structurally sound.

B. Form Lumber: WCLIB Construction Grade or Better, WWPA No. 1 or Better.

C. Plywood: PS 1-95, Group I, Exterior Grade B-B Plyform or better, minimum 5-ply and 3/4 inch thick for exposed locations and at least 5/8 inch thick for unexposed locations, grade marked, not mill oiled. Furnished plywood with medium or high density overlay is permitted.

D. Coated Form Plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent Noxcrete", or equal.

E. Tube Forms: Burke "SmoothTube," Sonoco "Seamless Sonotubes," or Alton Building Products "Sleek Seamless Standard Wall," of the type leaving no marks in concrete, one-piece lengths for required heights.

F. Joist Forms: Code recognized steel or molded plastic types as required.

G. Special Forms: For exposed integrally-colored concrete, plywood as above with high density overlay, plywood with integral structural hardboard facing or fibrous glass reinforced plastic facing, providing specified finish.

H. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type, not leaving metal within 1-1/2 inch of concrete surface.

I. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Burke Concrete Accessories, or "Cast-Off" by Sonneborn Building Products. Where form liners are furnished, provide form coatings recommended by form liner manufacturer.

J. Form Liner: Rigid or resilient type by L.M. Scofield, Labrado Forms, Symons, Greenstreak, or equal, types shown or directed, matching approved Sample.

K. Void Forms: Manufactured by SureVoid Products, Inc, or equal. Forms shall be "WallVoid" for temporary support of concrete walls and grade beams spanning between supports, and "SlabVoid" for creating gaps between concrete slabs or steps and underlying soils. Void forms shall be fabricated of corrugated paper with moisture resistant exterior, and shall be capable of withstanding working load of 1,500 psf. Provide accessories as required.

PART 3 - EXECUTION

3.1 GENERAL

A. Rigidly construct forms to prevent mortar leakage, sagging, displacement or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.

B. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members required by Drawings and Specifications, and shall be sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together to maintain position and shape. Forms and their supports shall be designed so that previously placed structures will not be damaged. Forms shall be true to line within tolerances as permitted under section 1.4 above.

3.2 FORM ERECTION AND REMOVAL:

A. Conform to ACI 301 and ACI 347 except as exceeded by the requirements of Code, regulatory agencies, or herein.

B. Construction: Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, location and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to Shop Drawings and requirements for work of other sections.

C. Camber: Place suitable jacks, wedges, or similar means to induce camber and to correct settlement in forms before and during concrete placing. Camber shall be as determined in pre-installation meeting specified above. In general, formwork shall be capable of accommodating camber of 1/8" per 10' of span plus 1/4". Provide Camber as noted on the Structural Drawings (if required).

D. Corners and Angles: Provide 3/4" by 3/4" beveled chamfer strips for all exposed concrete corners and angles unless otherwise indicated. Form concealed concrete corners and angles square unless otherwise indicated.

E. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing, and other equipment. Obtain required dimensions, details, and precise positions for work to be installed under other sections and form concrete accordingly.

F. Form Joints: Fill joints to produce smooth surfaces, intersections, and arises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.

G. Recesses, Drips, and Profiles: Provide smooth milled wood or pre-formed rubber or plastic shapes of types shown and required.

H. Cleanouts and Cleaning: Provide temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.

I. Re-Use: Clean and recondition form material before re-use.

J. Form Removal: Do not remove concrete forms until concrete attains sufficient strength to support its own weight and all superimposed loads as determined by testing field cured concrete cylinders, but not sooner than specified in ACI 347, paragraph 3.6.2.3, or 2019 CBC Section 1906A.2. Load supporting forms may be removed when concrete has attained 75 percent of required 28 day compressive strength, but no sooner than 3 days provided construction is reshored. Vertical formwork for cast-in-place concrete walls may be removed no sooner than 1 day following concrete placement, provided that contractor can demonstrate that no sloughing or sagging of concrete will occur.

1. Reshore structural members as specified per ACI 347-14.
2. Remove formwork progressively so unbalanced loads are not imposed on the structure.
3. Avoid damage concrete surfaces during form removal.
4. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.
5. Remove formwork in same sequence as concrete placement to achieve similar concrete surface coloration.

K. Reshoring:

1. Minimum reshoring shall be as per the requirements of ACI 347-14.
2. Record: Maintain a form and shoring removal record.
3. Contractor shall submit shoring/reshoring plans and calculations for review and approval. Calculations and plans shall be stamped and signed by a licensed civil or structural engineer. Reshoring loads to the lower floors shall be consistent with the design loads specified on the construction documents and with the acquired strength of the lower floors based on the time they have been allowed to cure before being loaded.

L. Shoring for Tributary Loads: Set temporary shoring for structural steel beams supporting cast-in-place concrete slabs. Such shoring is not required where beams are partially or totally encased with concrete nor for steel beams supporting concrete or masonry walls resting on the beams.

3.3 FORMWORK TOLERANCES:

A. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.

B. Finish Lines: Position formwork to maintain hardened concrete finish lines within following permissible deviations.

1. Variation from Plumb:

a.	In 10'-0"	1/4 inch
b.	In any story or 20'-0"	3/8 inch
c.	In 40'-0" or more	3/4 inch

2. Variation from Level or Grades Indicated

a.	In 10'-0"	1/4 inch
b.	In any bay or 20'-0" maximum	3/8 inch
c.	In 40'-0" or more	3/4 inch

3. Cross-Sectional Dimensions

a.	Minus	1/4 inch
b.	Plus	1/2 inch

C. Building Lines: Variation of linear building lines from established position in plan and related position of columns, walls and partitions:

1.	In any bay or 10'-0" maximum	1/2 inch
2.	In 40'-0" or more	1 inch

D. Slab Openings: Variations in size and location of sleeves and slab openings shall not exceed 1/4 inch.

3.4 SURVEY AND ADJUSTMENT:

A. Check forms before and during placement of concrete, using an instrument, and make corrections as work proceeds.

3.5 EMBEDDED PIPING AND ROUGH HARDWARE:

A. Comply with 2019 CBC, Section 1906A.3. Where work of other sections require openings for passage of pipes, conduits, ducts, and other inserts in the concrete, obtain all dimensions and other information. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other sections, according to following requirements.

B. Conduits or Pipes: Locate so as not to reduce strength of concrete. In no case place pipes, other than conduits, in a slab 4-1/2" thick or less. Conduit buried in a concrete slab shall not have an outside diameter greater than 1/3 the slab thickness nor be placed below the bottom reinforcing steel or over top reinforcing steel.

C. Conduits and pipes of aluminum shall not be embedded in structural concrete unless coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and reinforcing steel.

D. Sleeves: Pipe sleeves may pass through slabs or walls if not exposed to rusting or other deterioration and are of uncoated or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.

E. Conduits: Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than 3 diameters on centers, and do not impair the strength of the structure.

F. Clusters of Conduits:

1. Clusters of conduits embedded in a concrete slab shall not exceed 6 conduits per cluster and each conduit per cluster shall be individually spaced as per the above requirements. Conduit clusters exceeding this requirement shall be reviewed and approved by the structural engineer of record and DSA prior to the installation of the conduits.
2. If more than one conduit cluster is required in a specific area of the slab, routing and spacing of the clusters shall be reviewed and approved by the structural engineer of record and DSA prior to the installation of the conduits.
3. At no time shall the quantity and routing of clusters of conduits impair the strength of the concrete construction.

3.6 FIELD QUALITY CONTROL

A. Inspection: Obtain inspection and approval of forms before placing structural concrete.

3.7 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Reinforcing bars for cast-in-place concrete
2. Reinforcing mesh for cast-in-place concrete
3. Accessories, including but not limited to chairs and tie wires
4. Reinforcing bars for masonry
5. Reinforcing bars for site-cast pre-cast concrete
6. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all work.

C. Related Sections:

1. Section 01 4200: Testing and Inspection
2. Section 03 1000: Concrete Formwork
3. Section 03 3000: Cast-In-Place Concrete
4. Section 03 3310: Lightweight Concrete Fill
5. Section 04 2200: Concrete Unit Masonry

1.2 SYSTEM DESCRIPTION

A. Regulatory Requirements: Fabrication and placement of reinforcing shall be in accordance with requirements of 2019 CBC, Chapter 19A and ACI 318-14.

1.3 SUBMITTALS

A. Shop Drawings: Submit steel reinforcement Shop Drawings in accordance with ACI 315. Shop drawings should include complete layouts, sections, and details for congested conditions, typical bending diagrams and offsets, splice lengths and locations, proposed layout where vertical and horizontal bars intersect, and wherever welding is proposed, detailed to conform to AWS and 2019 CBC requirements. After approval of initial submission, subsequent submittals may be waived.

B. Contractor to prepare 3’ x 3’ sample mock-up on site for review and approval by Owner’s Representative prior to installation. Sample will show all concrete finishes, joints and colors.

C. Certification: Submit copies of welding operator's certificate.

D. Chemical Analysis: Provide for bars to be welded, in accordance with 2019 CBC, 1903A.7.

E. Closeout Submittals: Record exact locations of reinforcing that vary from Shop Drawings.

1.4 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.
2. American Welding Society (AWS).
3. American Concrete Institute (ACI).
4. 2019 CBC, Chapter 19A, Concrete.

B. Source Quality Control: Refer to Division 01 Sections & 2019 CBC Sections 1916A.2 and 1903A.7 for general requirements and to following paragraphs for specific procedures. Testing laboratory

retained by the Owner shall perform following conformance testing, select test Samples of bars, ties, and stirrups from the material at the Project site or from the place of distribution, with each Sample consisting of not less than two 18 inch long pieces, and perform the following tests according to ASTM A 615 and/or ASTM A 706.

1. Identified Bars: If Samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with the identification certificate so as to be readily identified, perform one tensile and one bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when Samples are selected.
2. Unidentified Bars: When positive identification of reinforcing bars cannot be performed and when random Samples are obtained, perform tests for each 2.5 tons or fraction thereof, one tensile and one bend test from each size of bars.
3. Testing to be per 2019 CBC Sections 1916A.2 & 1704A.3.1.4.

C. Certification of Welders: Shop and Project site welding shall be performed by certified welding operators.

1.5 DELIVERY, STORAGE AND HANDLING

A. Avoid exposure to dirt, moisture or conditions harmful to reinforcing.

B. Reinforcing steel bars, wire, and wire fabric shall be stored on the Project site to permit easy access for examination and identification of each shipment. Material of each shipment shall be separated for size and shape. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

PART 2 - PRODUCTS

2.1 GENERAL

A. Provide reinforcing of sizes, gages and lengths indicated, bent to indicated shapes.

2.2 MATERIALS

A. Steel Reinforcing Bars: ASTM A 615, or ASTM A 706 deformed grade 60 billet steel unless otherwise specified or indicated. Deformations to be per ASTM A-305.

B. Reinforcing Bars for welding: ASTM A706, Grade 60.

C. Reinforcing Mesh: ASTM A185, mesh size and gauge as shown, 60 ksi minimum tensile strength. Provide mesh in flat sheets only.

D. Tie Wire: ASTM A 82, fully annealed, copper-bearing steel wire, 16 gage minimum.

E. Chairs and similar support items:

1. Standard manufactured products conforming to CRSI Manual of Standard Practice and ACI 315.
2. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.

F. Welding electrodes: AWS D1.4, Table 5.1 and 5.3 low hydrogen electrodes, E9018 for Grade 60 steel.

G. Welded plain wire fabric shall conform to ASTM A-185. Welded deformed wire fabric shall conform to ASTM A-497.

2.3 FABRICATION OF REINFORCING BARS:

A. Comply with CRSI Manual of Standard Practice for Reinforced Concrete Construction for fabrication of reinforcing steel.

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are not permitted. Provide only tested and permitted bar materials.

C. Welding: Provide only ASTM A 706 steel where welding is indicated. Perform welding per CBC Section 1903A.4 by the direct electric arc process in accordance with AWS D1.4 and specified low-hydrogen electrodes. Preheat 6 inches each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is not permitted. Do not tack weld bars. Clean metal surfaces to be welded of loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds deemed defective, using chisel, and replace with proper welding. Prequalification of welds shall be in accordance with CBC requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Bars shall be bent cold. Bars partially embedded in concrete shall not be field bent except as indicated on reviewed Shop Drawings. Before installation, and again before concrete is placed, clean reinforcing of loose scale, rust, oil, dirt and any coating that could reduce bond.

B. Securing in Place: Accurately place bars and wire tie in precise position where bars cross. Bend ends of wire ties away from the forms. Wire tie bars to corners of ties and stirrups. Support bars according to the current edition of “Recommended Practice for Placing Bar Supports” of Concrete Reinforcing Steel Institute, using approved accessories and chairs. Place precast concrete cubes with embedded wire ties to support reinforcing steel bars in concrete placed on grade and in footings. Use care not to damage vapor barriers where they occur. Accurately position, install, and secure reinforcing to prevent displacement during the placement of concrete.

C. Exposed Concrete Surfaces: Provide stainless steel or exterior quality vinyl plastic tipped chairs, bolsters, and accessories where exposed on exterior or interior concrete surfaces not to be painted or permanently covered. Provide metal chairs to hold reinforcement the required distance above form bottoms. In beams and slab construction, provide chairs under top slab reinforcement as well as under bottom reinforcement. Space chairs so that reinforcement will not be displaced during installation. Provide metal spacers to secure proper spacing. Stirrups shall be accurately and securely wired to bars at both top and bottom. At slabs, footings, and beams in contact with earth, provide concrete blocks to support reinforcement at required distance above grade.

D. Clearances: Maintain minimum clear distances between reinforcing bars and face of concrete as indicated on Structural Drawings.

E. Splices: Do not splice reinforcing bars at the points of maximum stress except where indicated. Lap splices as shown or required to develop the full strength or stress of bars. Stagger splices in horizontal wall bars at least 48" longitudinally in alternate bars and opposite faces.

F. Field Welding of Bars: As specified on plans for fabrication. All welding to be per CBC Section1903A.4.

G. Maintaining Bars In Position: Take adequate precautions to assure that reinforcing position and spacing is maintained during placement of concrete.

H. Reinforcing Mesh: Lap one full mesh plus 2", or 9" whichever is greater, at splices, wire tie, and support the same as specified for bars.

3.2 FIELD QUALITY CONTROL:

A. Supervision: Perform Work to this Section under supervision of a capable superintendent.

B. Inspection: Obtain inspection per CBC Sections 1704A.3.1.4 & 1916A.2 and approval of reinforcing before concrete is placed.

C. Welding Inspection: Whether welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the Testing Laboratory Welding Inspector who is specially qualified and approved by DSA in accordance with CBC Section 1704A.3.1.4. The welding inspector shall make a systematic record of all welds.
This record shall include:

1. Identification marks of welders;
2. List of defective welds;
3. Manner of correction of defects;

The welding inspector shall check the material, equipment details of construction, and procedures as well as the welds. The inspector shall also check the ability of the welder. The welder shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding which is required to be inspected is proper and has been done in conformity with the approved plans and specifications. The welding inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection, which the inspector may deem necessary to assure the adequacy of the welding.

3.3 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.4 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

PSECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Cast-in-place concrete placement and finishing.

C. Related Sections:

1. Section 01 4200: Testing and Inspection.
2. Section 03 1000: Concrete Forms and Accessories.
3. Section 03 2000: Concrete Reinforcement.

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations of cast-in-place concrete Work, dimensioned locations and types of construction and expansion joints, and accessory items such as vapor barriers. Include details and locations of reinforcing, embedded items, and interfacing with other Work.

B. Product Data:

1. Mix Design: Submit a concrete mix design for each mix that will be provided for the Work. Include intended locations for use, water/ cement ratio, size of coarse aggregate and amount of any admixture. Predict minimum compressive strength, maximum slump and air content percentage. Limit water content per cubic yard of mixed concrete to 285 pounds maximum.
2. Manufacturer of ready-mixed concrete shall deliver to the IOR a certificate with each mixer truck. Certificate shall bear the signature of representative of the testing laboratory, and shall state quantity of cement, water, fine and coarse aggregate and admixtures.

C. Material Samples: Contractor to provide 3’ x 3’ mock-up samples for each type of concrete color, finish and jointing for Owner’s approval prior to installation.

D. Certificates: Submit a notarized certificate that each of following conforms to standards indicated:

1. Aggregates – ASTM Standards C33
2. Admixtures - ASTM Standards C260
3. Curing materials - ASTM Standards C171

1.3 QUALITY ASSURANCE

A. Concrete Manufacturer: Furnish concrete from licensed commercial ready-mix concrete plant conforming to DSA approved plans as well as ACI 318-14 as modified by 2019 CBC sections 1903A, 1904A, 1905A, and 1916A.

B. Allowable Tolerances: Construct concrete conforming to the tolerances specified in ACI 117 "Recommended Tolerances for Concrete Construction and Materials", as applicable, unless exceeded by requirements of regulatory agencies or otherwise indicated or specified.

C. Comply with the following American Concrete Institute (ACI) Publications as a minimum requirement:

1. ACI 211 - Recommended Practice for Selecting Proportions of Concrete.
2. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
3. ACI 305 - Recommended Practice for Hot Weather Concreting.
4. ACI 306 - Recommended Practice for Cold Weather Concreting.
5. ACI 308 - Recommended Practice for Curing Concrete.

6. ACI 309 - Recommended Practice for Consolidation of Concrete.

D. Comply with the following American Society for Testing and Materials (ASTM) Standards as a minimum requirement:

1. ASTM A 185 - Welded Steel Wire Fabric For Concrete Reinforcement.
2. ASTM C 31 - Making and Curing Concrete Test Specimens in the Field.
3. ASTM C 33 - Concrete Aggregates.
4. ASTM C 39 - Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C 88 - Soundness of Aggregates by use of Sulphate or Magnesium Sulphate.
6. ASTM C 94 - Ready-Mixed Concrete.
7. ASTM C 143 - Slump of Hydraulic Cement Concrete.
8. ASTM C 150 - Portland Cement.
9. ASTM C 171 - Sheet Materials for Curing Concrete.
10. ASTM C 172 - Sampling Freshly Mixed Concrete.
11. ASTM C 173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.
12. ASTM C 227 - Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
13. ASTM C 231 - Air Content of Freshly Mixed Concrete by the Pressure Method.
14. ASTM C 260 - Air-Entraining Admixtures for Concrete.
15. ASTM C 289 - Potential Reactivity of Aggregates (Chemical Method).
16. ASTM D 1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

E. Source Quality Control: Refer to the following paragraphs for specific procedures. Concrete materials which, by previous tests or actual service, have shown conformance may be used without testing when so approved by the Architect and DSA. Testing Laboratory shall perform following conformance testing.

1. Portland Cement: Furnish mill certificates in accordance with the 2019 CBC section 1916A.1 and acceptable to Architect and DSA, showing conformance with requirements specified.
2. Cementitious Material Test. The concrete supplier shall furnish to the enforcement agency certification from the cement manufacturer that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C 150 for Portland cement and ASTM C 595 or ASTM C 1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification from the manufacturer that they have been manufactured and tested in compliance with ASTM C 618 or ASTM C 989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier’s certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used per section 1916A.1 of the 2019 CBC.
3. Aggregates for Normal Weight Concrete: Test the aggregate before and after concrete mix is designed and whenever character of aggregate varies or source of material is changed in accordance with ASTM C33 and 2019 CBC section 1903A.3. Include a sieve analysis. Obtain samples of aggregates at the dry batching or ready-mix concrete plant in accordance with ASTM D75 and perform tests for the properties listed in the following table.
4. Aggregates for Lightweight Concrete: Test the lightweight aggregates before mix is designed and whenever the character of aggregate varies or source is changed in accordance ASTM C330 and 2019 CBC section 1903A.3 Include sieve analyses, report on unit weights, report on deleterious substances, unburned or under-burned lumps, loss on ignition, soundness, staining materials, and crushed particles in coarse aggregate. Splitting tensile strength (FSP); 5.5 minimum.

PHYSICAL PROPERTIES		
Physical Properties, units	Test Method	Minimum values
Sieve analysis	ASTM C136	
Organic impurities	ASTM C40	Fine aggregate not darker than reference standard color
Soundness	ASTM C88	Loss after 5 cycles not more than 8 percent of coarse aggregate, nor more than 10 percent of fine aggregate
Abrasion	ASTM C131	Weight loss not more than 10.5 percent after 100 revolutions, 42 percent after 500 revolutions
Deleterious materials	ASTM C33	
Materials finer than No. 200 sieve	ASTM C117	Not over 1 percent for gravel, 1.5 percent for crushed aggregate
Reactivity potential	ASTM C227, C289, C342	Ratio of silica released to reduction in alkalinity not to exceed 1.0.
Sand equivalent	ASTM D2419	California sand equivalent values operating range not below 71 percent

F. Concrete Batch Plant Inspections: Conform to 2019 CBC section 1704A.4.2. Continuous batch plant inspection is required for structural concrete, performed by a specially qualified inspector approved by DSA. As allowed by 2019 CBC section, 1704A.4.3, batch plant inspection may be waived provided all the requirements in 2019 CBC section 1704A.4.4 are satisfied. DSA approval will be required prior to the waiving batch plant inspection.

G. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.

1.4 CONCRETE MIX DESIGNS

A. A registered civil engineer with experience in concrete mix design shall select the relative amounts of ingredients to be used as basic proportions of the concrete mixes proposed for use under the provisions of ACI 318 Section 5.2 as modified by 2019 CBC section 1905A.2. Mixes shall be based on existing approved compressive strength test data for concrete mixes in accordance with ACI 318 Section 5.3.1.1 and requirements below:

B. Strength Requirements: Design mixes for structural concrete for minimum 28-day compressive strengths required by Drawings and Specifications. The trial batch strength for each mix shall exceed indicated or specified strength by 750 psi or a lesser amount based on the standard deviations of strength test records according to ACI 318.

C. Normal Weight Concrete Mix Design: Design all mixes for workability and durability of concrete. Control the mixes in accordance with ACI 318 Section 5.2, ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete, and Chapter 4, ACI 318, Building Code Requirements for Reinforced Concrete. Make adjustments in cement content required for concrete strengths at Contractor's expense and do not exceed 0.60 (or as indicated on concrete general notes of approved plans) absolute water-cement or cement plus fly ash ratio by

weight. Do not use calcium chloride or any admix containing such material. Admixtures containing a material releasing nitrates in solution are limited to 0.06 percent by weight for the chloride ion.

D. Maximum Aggregate Sizes: Not exceeding 3/4 of minimum clear space between bars and between bars and forms, nor larger than 1/5 of least dimensions between the forms.

E. Design the mixes with 1" maximum size, except maximum 1-1/2" size for foundations and maximum 3/8" size at congested reinforcing or thin sections, as submitted by the contractor and approved by the Architect and Structural Engineer of Record.

F. Light Weight Structural Concrete: Design mixes in accordance with ACI 318 Section 5.2 and Section 5.3.1.1, and control mix in accordance with ACI 211.2, Standard Practices for Selecting Proportions for Structural Light Concrete. Design for air-dry density of 110 pounds per cubic foot maximum. With each mix design submit test reports showing concretes covered by the mix designs meet shrinkage test requirements specified under Article “Field Quality Control” hereinafter or include certified test reports showing conformance as furnished by the ready-mix concrete manufacturer.

G. ACI 318 Section 5.3.1.1 with test records. Where a testing laboratory acceptable to the enforcement agency has records of compressive strength tests, a standard deviation shall be established. Test records from which a standard deviation is calculated shall:

1. Represent materials, quality control procedures and conditions similar to those expected, and changes in materials and proportions within the test records shall not have been more restricted than those for proposed work.
2. Represent concrete produced to meet a specified strength or strengths f’ c within 1,000 psi of that specified for proposed work.
3. Must consist of at least 30 consecutive tests or two groups of consecutive tests totaling at least 30 tests as defined in ACI 318 Section 5.6.2.4, except as provided in ACI 318 Section 5.3.1.2.

1.5 DELIVERY, STORAGE AND HANDLING

A. Mixing and Placing Concrete: Refer to Section 01 4200: Testing and Inspection.

B. Ready-mix concrete shall be mixed and delivered in accordance with ASTM C 94. Each batch of concrete delivered to the Project site shall be accompanied by a time slip bearing departure time and signature of batch plant supervisor. Concrete shall be placed within 90 minutes after start of mixing. Deliver all materials in timely manner to ensure uninterrupted progress of the work.

C. Store cement and aggregate materials so as to prevent their deterioration or intrusion by foreign matter. Deteriorated or contaminated materials shall not be furnished.

1.6 JOB CONDITIONS

A. Cold Weather Requirements:

1. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. Surfaces, in which concrete is to come in contact with, shall be free from frost or ice. No frozen materials or materials containing ice shall be furnished.
2. When placing concrete during freezing or near-freezing weather the mix shall have a temperature of at least 50 degrees F., but not more than 90 degrees F. when cement is added. Concrete shall be maintained at a temperature of at least 50 degrees F. for at least 72 hours after placing or until it has thoroughly hydrated. When necessary, concrete materials shall be heated before mixing. Special precautions shall be provided for protection of transit-mixed concrete.

B. Hot Weather Requirements: During hot weather, proper attention shall be provided for ingredients, produdtion methods, handling, placing, protection and curing, to prevent excessive concrete temperatures or water evaporation which could impair required strength or durability.

PART 2 - PRODUCTS

2.1 GENERAL

A. Ready-Mixed Concrete: Mix and deliver in accordance with requirements of 2019 CBC Chapter 1905A.

2.2 MATERIALS

B. Portland cement: ASTM C-150, Type II/V, low alkali. Do not change brand without prior approval.

C. Aggregates: ASTM C33 and C 227, from approved pits, free from vegetable matter and of opaline, feldspar, or siliceous magnesium substances; all washed, clean, hard, fine-grained sound crushed rock or gravel; not over 5 percent by weight of flat, thin, elongated, friable, or laminated pieces (pieces having major dimension over 5 times average dimension) or more than 2 percent by weight of shale or cherty material. Any suitable individual grading of coarse aggregate may be furnished, provided Grading of Combined Aggregate indicated in following table is obtained. Refer to Section 01 42 00: Testing and Inspection.

GRADING OF COMBINED AGGREGATE

Sieve Number or Size in Inches	1-1/2" Maximum	1" Maximum	3/4" Maximum
Passing a 2"	------	------	------
Passing a 1-1/2"	95-100	------	------
Passing a 1"	70-90	90-100	------
Passing a 3/4"	50-80	70-95	90-100
Passing a 3/8"	40-60	45-70	55-75
Passing a No. 4	35-55	35-55	40-60
Passing a No. 8	25-40	27-45	30-46
Passing a No. 16	16-34	20-38	23-40
Passing a No. 30	12-25	12-27	13-28
Passing a No. 50	2-12	5-15	5-15
Passing a No. 100	0-3	0-5	0-5

D. Water: Water shall be potable and free from deleterious matter.

E. Pozzolan: ASTM C618, Class F or N Fly Ash, 100 pounds maximum per cubic yard, containing one percent or less carbon. Fly ash shall not be used in excess of 15 percent by weight of total cement quantity.

F. Admixtures: ACI 318 Section 3.6.5, Type A or D, manufactured by Grace or approved equal. Admixtures to be used in concrete shall be subject to prior approval by DSA.

G. Expansion Joint Fillers: Preformed strips, non-extruding and resilient bituminous type, of thickness indicated, conforming to ASTM D 1751 and ASTM D1752.

H. Construction Joint Materials: "Key-Kold" or "Kwik-Joint," of profiles indicated.

I. Curing Paper and Liquid Curing Compounds:

1. Curing Paper: Non-staining white type conforming to ASTM C 171.
2. Liquid Curing Compounds: A standard brand complying with Rule II 13 of the South Coast Air Quality Management District and Federal Air Quality Regulation 40 CFR 52.254, clear liquid conforming to ASTM C 309, Master Builders, Grace, Antihydro.

J. Underlayment: Latex underlayment for filling low spots in concrete shall be Tile-Tex by Flintkote Co., Webtex #60 or Fixallatex by Dowman Products Co.

K. Vapor Barrier: Vapor barrier shall be installed below all slabs poured on grade conforming to ASTM E 1745. Barrier shall have a permeance rating of 0.01 perms or less, an impact strength greater than 70 grams per mil, and must be resistant to deterioration. Provide minimum 2-inch wide waterproof plastic self-adhering tape for sealing edges and ends of sheeting.

L. Non-shrink grout:

1. For concealed areas: Master Builders "Embeco 885," or equal, non-gas-forming and free of oxidizing catalysts and inorganic accelerators, used as dry or damp pack, or mixed to a 20-second flow (CRC-C 611), without segregation or bleeding at any temperature between 45 degrees F and 100 degrees F. Working time 30 minutes or more.
2. For exposed areas: Master Builders "Masterflow 928," with same characteristics as specified for concealed areas.

M. Drypack: Field mixture of I part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. In lieu of field mixing, Contractor may use factory mixed drypack material, such as Master Builders "Set Grout."

N. Epoxy Grout: Master Builders "Ceilcote 648," or equal.

O. Bonding Agent: "Weld-Crete," manufactured by Larsen Products Co., P.O. Box 2127, Rockville, MD 20852, Master Builders "Concresive," or equal.

P. Stair Strips and Nosing: Provide strips and nosings where indicated on the drawings.

1. Fabricated from 6063-T5 extruded aluminum, mill finish. Anti-slip filler shall contain at least 60 percent virgin grain aluminum oxide abrasive. Binder shall be fully cured resilient type epoxy, with binder-to-filler ratio of 13 percent. The epoxy-abrasive filler shall extend over the curved front edge of the nosing and shall be securely bonded to the extruded aluminum base.
2. Manufactured by Wooster Products Inc. American Safety Tread Co. Inc., or equal.
3. Nosing and strips for concrete casting shall be provided with Sure-Hold anchors, chevron shaped continuous full length of nosing or strip.
4. Nosings and anchors for attachment to hydrated concrete stairs shall be similar to those specified below, except they shall be provided with countersunk holes for screws and fasteners.
5. Colors: As selected by Architect to contrast with stair color. Colors shall extend uniformly through the filler.
6. Strip and Nosing Types:

    a. Nosings for sloped riser steel pan stairs: Type WP4J, 4-1/16 inches wide, 3/8 inch thick.
    b. Nosings for new concrete stairs: Type WP4C, 4-1/16 inches wide, 3/8 inch thick, nose projects down 1/4 inch.
    c. Nosings for square edged steel pan stairs: Type WP4SP, 4-1/16 inches wide, 3/8 inch thick nose.
    d. Strips for recessing into concrete stairs: Type WP1A, except 2-1/4 inches wide, 3/8 inch thick. American Safety Tread Co., Type 24, or equal.

2.3 CONCRETE MIXING

A. Furnish ready-mixed concrete from an approved commercial off-site plant. Conform to ASTM C 94, except materials, testing, and mix designs as specified herein. Use transit mixer trucks equipped with automatic devices for recording number of revolutions of drum. Comply with 2019 CBC Section, 1905A.

B. Admixtures: All approved admixtures shall be introduced into the concrete at the batch plant. Field additions are not acceptable.

C. Slump: Adjust quantity of water so concrete at point and time of placing does not exceed the slumps per plans when tested according to ASTM C143. Use the minimum water necessary for workability required by part of structure being cast.

PART 3 - EXECUTION

3.1 GENERAL

A. Time of Placing: Do not place concrete until reinforcement, conduits, outlet boxes, anchors, hangers, sleeves, bolts, and other embedded materials are securely fastened in place. Contact the IOR at least 24 hours before placing concrete; do not place concrete until inspected by the IOR.

B. Pouring Record: A record shall be kept on the Project site of time and date of placing concrete in each portion of structure. Such record shall be maintained on the Project site until Substantial Completion and shall be available for examination by the Architect and DSA.

3.2 PREPARATION

A. Moisture Barrier: Before installation of screeds and slab reinforcement, install a moisture barrier under slabs on grade. Place membrane in as large sheets as possible, lapped 12 inches at sides and ends, with top lap placed in the direction of the spreading of concrete. Extend membrane and lap at least 4 inches onto adjoining wall surfaces and seal with pressure-sensitive tape.

1. Install moisture barrier on minimum 2-inch bed of sand, unless otherwise indicated, over gravel base as indicated on the Drawings.
2. Patch punctures and tears in moisture barrier.

B. Reglets and Rebates:

1. Form reglets and rebates in concrete to receive flashing, frames and other equipment as detailed and required. Coordinate dimensions and locations required with other related Work.
2. If concrete slabs on grade adjoin a wall or other perpendicular concrete surface, form a reglet in wall to receive and carry horizontal concrete Work. Reglet shall be full thickness of the slab and shall be 3/4 inch wide, unless otherwise indicated. Requirement does not apply to exterior walks, unless specifically indicated.

C. Screeds: Install screeds accurately and maintain at required grade or slab elevations after steel reinforcement has been installed, but before starting to place concrete. Install screeds adjacent to walls and in parallel rows not to exceed 8 feet on centers.

D. Screeds over Vapor Barrier: Use weighted pad or cradle type screeds and do not drive stakes through the vapor barrier. Check with an instrument level, transit, or laser.

E. Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.

F. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce adsorption and to help maintain concrete workability.

G. Earth Subgrade: Dampen 24 hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness and remove loose material.

H. Gravel Fill: Recompact disturbed gravel and bring to correct elevation.

I. Sand Beds or Subslab Drainage Fill: Recompact disturbed material and bring to correct elevation.

3.3 INSTALLATION

A. Conveying and Placing:

1. Do not place concrete until reinforcing steel and forms or decks have been approved by the Inspector and other authorities having jurisdiction. Concrete shall be placed only under direct observation of the IOR. Do not place concrete outside of regular working hours, unless the IOR has been notified at least 48 hours in advance.
2. Comply with 2019 CBC Sections 1905A.9 and 1905A.10.
3. Concrete shall be conveyed from mixer to location of final placement by methods, which will prevent separation or loss of materials. Place concrete in horizontal layers not more than 18" thick within 90 minutes after water is first added to the batch.
4. Concrete shall be placed as nearly as practicable to its final position to avoid segregation due to re-handling or flowing. No concrete that has partially hydrated or has been contaminated by foreign materials shall be placed, nor shall re-tempered concrete or concrete which has been remixed after initial set be placed.
5. In placing concrete in columns, walls or thin sections, provide openings in forms, elephant trunks, tremies or other recognized devices, to prevent segregation and accumulation of partially hydrated concrete on forms or metal reinforcement above level of concrete being

placed. Such devices shall be installed so that concrete will be dropped vertically. Unconfined vertical drop of concrete from end of such devices to final placement surface shall not exceed 5-feet for concealed concrete or over 3-feet for exposed concrete.

6. Concrete shall be placed as a continuous operation until placing of panel or section is completed. Top surfaces of vertically formed lifts shall be level.
7. Concrete shall be thoroughly consolidated during placement, and shall be worked around reinforcement and embedded fixtures with mechanical vibrators.
8. Where conditions make consolidation difficult, or where reinforcement is congested, batches of concrete adjusted to use smaller size aggregates than specified in the mix design shall be used as approved by the Architect, Structural Engineer and the Enforcement Agency.
9. Where new concrete is placed against or on old or existing concrete, apply bonding agent to surface of old concrete prior to placement of new concrete.

B. Compaction and Screeding:

1. Compacting: Compact each layer of the concrete as placed with mechanical vibrators or equivalent equipment. Transmit vibration directly to concrete and in no case through the forms unless approved. Accomplish thorough compaction. Supplement by rodding or spading by hand adjacent to forms. Compact concrete into corners and angles of forms and around reinforcement and embedded fixtures. Recompact deep sections with congestion due to reinforcing steel as required.
2. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation.
3. Tamp freshly placed concrete with a heavy tamper until at least 3/8 inch of mortar is brought to surface. Concrete shall then be tamped with a light tamper and screeded with a heavy straightedge until depressions and irregularities are eliminated, and surface is true to finish grades or elevations. Remove excess water and debris.
4. Where slabs are to receive separate cement finish or mortar setting bed, continued tamping to raise mortar to surface is not performed. Laitance shall be removed by brushing with a stiff brush or by light sandblasting to expose clean top surface of coarse aggregate.

C. Floating and Troweling:

1. When concrete has hydrated sufficiently, it shall be floated to a compact and smooth surface. After floating, wait until concrete has reached proper consistency before troweling. Top surfaces shall receive at least 2 troweling operations with steel hand trowel. Prior to and during final troweling, apply a fine mist of water frequently with an atomizing type fog sprayer. Omit troweling for slabs to receive a separate cement finish.
2. Non-architectural vertical concrete surfaces shall be finished smooth and free from marks or other surface defects.

D. Joints: Comply with 2019 CBC Section 1906A.4. Locate joints in concrete only where shown or approved and obtain prior approval for points of stoppage of any pour. Clean and roughen surface of construction joints by removing entire surface and exposing 1/4" of clean coarse aggregate solidly embedded in mortar matrix by sandblasting, chipping, use of an approved retarder agent, or equal. Water and keep hardened concrete wet for not less than 24 hours before placing the next lift or abutting concrete. Cover the horizontal surfaces of existing or previously placed and hardened concrete with a 2" thick layer of fresh concrete of required mix less 50 percent of coarse aggregate just before balance of concrete is placed.

E. Vertical Elements: Stop placement of concrete in walls and columns 1-1/2" below bottom of beams or supported slabs. Stop placement at sills and heads of wall openings in the same manner. Allow concrete in vertical elements to be in place at least 2 hours and until vertical settlement has ceased before placing concrete for floor framing.

F. Correction of Segregation: Before placing next layer of concrete, and at the top of each placement for vertical elements, remove all concrete containing excess water or fine aggregate, or showing

deficiency of coarse aggregate, and fill the space with compacted concrete of correct proportions. Comply with 2019 CBC Section, 1906A.4.

G. Curing:

1. All curing shall be per 2019 CBC Section 1905A.11. Keep forms containing concrete in a wet condition until removed. Keep concrete continuously moist for not less than 7 days after placement. Keep concrete above 50ºF and moist with a fine fog water spray until protected by curing media.
2. Forms containing concrete, top of concrete between forms, and exposed concrete surfaces after removal of forms shall be maintained in a thoroughly wet condition for at least 7 consecutive days after placing. Use the water curing method, curing sheet material, or a clear liquid membrane-forming curing compound except as otherwise specified.
3. During times of dry or excessive winds, high ambient temperature, low humidity, or other ambient conditions causing rapid drying, use specified evaporation retardant and finishing aid material according to the manufacturers instructions and cure concrete with a fine fog spray of water, or equal, applied both during and after finishing and continued until final curing operations are started.
4. Within 24 hours after finishing, exterior slabs and paving, and interior slabs to receive cement topping or mortar setting beds, shall be covered with sand to a depth of 2 inches and kept thoroughly wet for 7 days.

    a. Instead of sand covering, exterior walks and paving where no other surface treatment is specified, may be cured with clear liquid curing compound immediately installed in accordance with manufacturer's directions.

H. Filling, Leveling and Patching:

1. Concrete slabs exhibiting high or low spots and indicated to receive resilient floor covering or soft floor covering, shall have surfaces repaired. High spots shall be honed, or ground with power-driven machines to required tolerances. Low spots shall be filled with latex underlayment, installed in strict accordance with manufacturer's written recommendations.
2. Holes resulting from form ties or sleeve nuts shall be solidly packed, through exterior walls, by pressure grouting with cement grout, as specified. Grouted holes on exposed surfaces shall be screeded flush and finished to match adjoining surfaces.

I. Cement Base: Cement base shall be of the height, thickness, and shape detailed. Base shall be reinforced with one inch mesh, 18 gage, zinc-coated wire fabric. Base finish mixture shall be one part Portland cement, 2 parts of fine aggregate and one part pea gravel. Colored cement base shall include a chemically inert mineral oxide pigment in the mix.

3.4 GROUTING AND DRYPACKING

A. Install as indicated or required. Where grouting and drypacking is part of the work of other sections, it shall conform to the following requirements, as applicable.

B. Drypacking: Mix materials thoroughly with minimum amount of water. Install drypack by forcing and rodding to fill voids and provide complete bearing under plates. Finish exposed surfaces smooth and cure with damp burlap or liquid curing compound.

C. Non-Shrink Grouting:

1. Mixing: Mix the approved non-shrink grout material with sufficient water per manufacturers recommendations.
2. Application: Surfaces to receive the non-shrink grout shall be clean, and shall be moistened thoroughly immediately before placing the mortar. Before grouting, surfaces to be in contact shall be roughened and cleaned thoroughly, all loose particles shall be removed and the surface flushed thoroughly with neat cement grout immediately before the grouting mortar is placed. Place fluid grout from one side only and puddle, chain, or pump for complete filling of voids; do not remove the dams or forms until grout attains initial set. Finish exposed surfaces smooth, and cure as recommended by grout manufacturer.

3.5 FINISHING NON-ARCHITECTURAL CONCRETE

A. Soda and Acid Wash: Concrete surfaces to receive plaster, paint or other finish, and which have been formed by oil coated forms, shall be scrubbed with a solution of 1-1/2 pounds of caustic soda to one gallon of water. Surfaces where smooth wood or waste molds have been furnished shall be scrubbed with a solution of 20 percent muriatic acid. Wash with clean water after scrubbing.

B. Sacking: Exposed concrete curbs, and other similar surfaces shall be sacked by an application of Portland cement grout, floated, and rubbed. Sacking shall not be performed until patching and filling of holes has been completed. Entire sacking operation for any continuous area shall be started and completed within the same day.

1. Mix one part portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout having consistency of thick paint. Wet surface of concrete sufficiently to prevent absorption of water from grout. Apply grout uniformly with a brush or spray gun, then immediately float surface with a cork or other suitable float, scouring wall vigorously.
2. While grout is still plastic, finish surface with a sponge-rubber float, removing excess grout. Allow surface to dry thoroughly, then rub vigorously with dry burlap to completely remove dried grout. No visible film or grout shall remain after rubbing with burlap.

C. Sandblasting: Exterior concrete surfaces to receive stucco dash coat finish, where plywood or other smooth forms have been furnished, shall be uniformly sand-blasted with sharp quartz sand under sufficient air pressure to remove dirt, form oil and other foreign materials, and roughen surface to provide a proper bond. Such surfaces shall be thoroughly washed with clean water after sandblasting.

D. Abrasive: Concrete stair treads, landings, ramps and steps on interior and exterior of buildings, and interior exposed concrete floors in shop buildings shall receive an abrasive finish. Abrasive grains in amount of 30 pounds per 100 square feet shall be evenly installed by dust-on method and embedded into surface during first troweling operation. Additional abrasive grains, in amount of 30 pounds per 100 square feet, shall then be evenly installed and embedded into surface during final troweling operation.

E. Floor Hardener: Exposed interior concrete floors throughout shall be treated with floor hardener, as specified. Install hardener after surface of concrete has reached the point where no excess moisture is present, but while it is still plastic. Hardener shall be installed as follows:

1. Colored Hardener: Install at rate of 40 pounds per 100 square feet of surface for initial application.
2. Gray (natural) Hardener: Install at rate of 20 pounds per 100 square feet of surface for initial application.
3. Hardener shall be evenly distributed and thoroughly floated into surface mortar with a wood float. An additional 20 pounds of hardener, colored or gray, specified as above, shall be installed over each 100 square feet, and troweled to an even surface having uniform color and texture.
4. Cement Grout and Dry-Pack Concrete: Cement grout shall be mixed at the Project site and shall be composed of one volume of portland cement and 2-1/2 volumes of fine aggregate. Materials shall be mixed dry with sufficient water added to make mixture flow under its own weight. When grout is used as a dry pack concrete, add sufficient water to provide a stiff mixture, which can be molded into a sphere.

3.6 FIELD QUALITY CONTROL

A. Comply with pertinent provisions of Section 01 45 00.

B. Level of Floors: Continuously monitor concrete placing to maintain level floor by use of an instrument level, transit, or laser.

C. Continuous Inspection: Construct structural concrete under continuous inspection of Project Inspector. Obtain inspection and approval of forms and reinforcing by DSA as required and by the Inspector before placing structural concrete.

D. Testing/Evaluation of Concrete: Conform to ACI 318-14 Section 5.6.2 as modified by 2019 CBC Section 1905A.6.2. Testing Laboratory shall perform following tests. Samples for testing shall be obtained in accordance with ASTM C 172, and shall be taken from as close to point of placement as possible.

1. Compressive Strength Tests: Cast one set of three or more cylinders from each days placing and each 50 cubic yards, or fraction thereof, or not less than once for each 2,000 square feet of surface area for slabs and walls, of each strength of structural concrete. Additional samples for seven day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed. Date cylinders, assign record number, and tag showing the location from which sample was taken. Also record slump test result of sample. Do not make more than two series of tests from any one location or batch of concrete.
2. Test Cylinders: Samples will be made in accordance with ASTM C172. Cast cylinders according to ASTM C31; 24 hours later, store cylinders under moist curing conditions at about 70 F. Test according to ASTM C39 at 7 and 28 day ages. The remaining cylinder shall be kept in reserve in case tests are unsatisfactory.
3. Control Test Cylinders: Cast a set of two or more cylinders for each day's placing of concrete for slabs supported on shoring. Place test cylinders on slabs represented by cylinders and cure the same as slabs. Test cylinders to determine proper times for removal of shores and reshoring. A strength test shall be the average of the compressive strengths of 2 cylinders made from the same sample of concrete and tested at 28 days.

E. Core Tests: If tests show that compressive strength of any concrete falls below required minimum at 28 day age, coring and testing of concrete which unsatisfactory test reports represent may be directed. Testing Laboratory shall take and test drilled cores as directed in accordance with ASTM C42 and 2019 CBC Section 1917A.1. Contractor shall refill core holes with drypack concrete of the same compressive strength required for cored concrete. If core tests results are unsatisfactory, Contractor shall furnish required labor, equipment, and weights, and the Testing Laboratory shall conduct load testing on involved parts of building or structure as directed. Contractor shall bear additional curing and test costs, including Testing Laboratory costs, for concrete not meeting required compressive strength at 28 day age even if testing demonstrates that concrete has eventually attained required minimum compressive strength, and all costs for required corrections or removals and replacements as directed and required for approved construction.

3.7 EXPANSION AND CONSTRUCTION JOINTS

A. Construction Joints: Details and proposed location of construction joints shall be as indicated on the Drawings, located to least impair strength of structure, in accordance with the following:

1. Thoroughly clean contact surface by sand blasting entire surface not earlier than 5 days after initial placement.
2. A mix containing same proportion of sand and cement provided in concrete plus a maximum of 50 percent of coarse aggregate shall be placed to a depth of at least one inch on horizontal joints. Vertical joints shall be wetted and coated with a neat cement grout immediately before placing of new concrete.
3. Should contact surface become coated with earth, sawdust, or deleterious material of any kind after being cleaned, entire surface shall be re-cleaned before applying mix.

B. Expansion Joints: Provide expansion joints where indicated in walks and exterior slabs. Space approximately 20 feet apart (12 feet apart at traffic areas), unless otherwise indicated. Joints shall extend entirely through slab with joint filler in one piece for width of walk or slab. Joint filler shall be 3/8 inch thick, unless otherwise indicated.

C. Tooled Joints: Slabs, walks and paving shall be marked into areas as indicated with markings made with a V-grooving tool. Marks shall be round-edged, free from burrs or obstructions, with clean cut angles and shall be straight and true. Walks, if not indicated, shall be marked off into rectangles of not more than 12 square feet and shall have a center marking where more than 5 feet wide.

3.8 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 03 33 10

LIGHTWEIGHT CONCRETE FILL

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Hard rock lightweight concrete fill as indicated.

C. Related Sections:

1. Section 03 1000: Concrete Forms and Accessories
2. Section 03 2000: Concrete Reinforcement
3. Section 03 3000: Cast-In-Place Concrete

D. Comply with all relevant provisions of related sections noted above.

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locations to receive lightweight concrete and accessories.

B. Mix Design: Submit a concrete mix design for each mix that will be provided for the Work. Include water/cement ratio, size of aggregate and types and amounts of admixtures. Predict minimum compressive strength, maximum slump and air content percentage.

C. Certificates:

1. Submit a notarized certificate that each of following conforms to standards indicated.

a. Aggregates - Refer to Section 01 4200: Testing and Inspection.
b. Admixtures - ASTM Standards.
c. Curing materials - ASTM Standards.

2. Manufacturer of ready-mixed concrete shall deliver to the IOR a certificate with each mixer truck. Certificate shall bear the signature of representative of the testing laboratory, and shall state quantity of cement, water, fine and coarse aggregate and admixture contained in load.

1.3 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ASTM A 185 - Welded Steel Wire Fabric for Concrete Reinforcement.
2. ASTM C 33 - Concrete Aggregates.
3. ASTM C 171 - Sheet Materials for Curing Concrete.
4. ASTM C 260 - Air-Entraining Admixtures for Concrete.
5. ASTM C 330 - Lightweight Aggregates for Structural Concrete.

1.4 DELIVERY, STORAGE AND HANDLING

A. Each gradation of lightweight aggregates shall be stockpiled in separate bins or piles. Method of storage shall minimize segregation and prevent contamination. Aggregates shall remain dry. Do not presoak.

PART 2 - PRODUCTS

2.1 GENERAL

A. Designated mix shall be proportioned so as to provide concrete with a minimum compressive strength of 3000 psi at 28 days, and a maximum unit weight of 110 lbs. per cubic foot in the oven, dry condition, at 28 days.

2.2 MATERIALS

A. Portland Cement: Standard brand conforming to ASTM C 150

B. Aggregates:

1. Coarse Aggregate: Lightweight aggregate conforming to ASTM C 330, and shall be sealed expanded shale such as "Rocklite", as produced by Lightweight Processing Company, or equal.
2. Fine Aggregate: Hardrock aggregate conforming to ASTM C 33, or lightweight aggregate conforming to ASTM C 330.

C. Water shall be clean and free from deleterious amounts of oils, acids, alkalis, salts, or organic materials.

D. Admixture: Air entraining agent shall conform to ASTM C 260.

E. Reinforcing Mesh: Conform to ASTM A 185. Welded wire fabric shall be 4x4 W1.4/1.4 furnished in flat sheets.

F. Tie Wire: Fully annealed, copper-bearing steel wire, 16 gage minimum.

G. Curing Paper: Standard brand conforming to ASTM C 171 Type 1, regular.

PART 3 - EXECUTION

3.1 PREPARATION

A. Screeds: Install screeds accurately to finish floor surfaces at 19 feet on center, maximum, in one direction. Screeds shall be properly secured to prevent movement. Screeds shall be centered on column centerlines.

3.2 INSTALLATION

A. Placing and Finishing:

1. Concrete shall be placed in its final position immediately after mixing is completed. Excessive handling of concrete for final placement shall be minimized to prevent segregation.
2. After placement, concrete shall be rodded following specified concrete placement process. Rodded concrete shall then be tamped with a grid tamper. Re-rod in see-saw method to finished elevations. After screeds and screed supports are removed, concrete in removal areas shall be re-tamped.
3. Immediately following above operation and while concrete is plastic, surface shall be bull floated to level out tamp marks and humps. After floating, wait until concrete has reached proper consistency to start steel troweling. To maintain surface in proper condition for troweling, a light film of moisture may be applied with a mist type fog sprayer. Final (second) troweling operation shall provide a hard, non-slip surface, free from defects and blemishes.
4. Finished surface shall be within a tolerance of 1/8 inch in 10 feet.

B. Curing:

1. Lightweight concrete floor fills shall be properly cured and protected against damage during construction operations.
2. Placement of curing paper shall immediately follow final troweling operation. If concrete surfaces start to dry due to high air temperatures or wind, spray concrete surface with a fine water mist.
3. Curing paper shall be lapped 3 inches and sealed. Edges shall be cemented to finish. Paper that is torn or otherwise damaged during curing period shall be immediately repaired or replaced. Paper shall remain in place for a minimum of 7 days.
4. After removal of curing paper, cement surface shall be thoroughly washed and mopped clean.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.4 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 03 35 00

POLISHED CONCRETE FINISHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Polished concrete.

B. Dyed and polished concrete.

1.2 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

A. American Concrete Institute (ACI): ACI 302.1R - Guide for Concrete Floor and Slab Construction.

B. American National Standards Institute (ANSI): Standards B-101.1/2009.

C. ASTM International (ASTM):
1. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
2. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete.
3. ASTM C 779 - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.

D. Test Method 11.4 - Standard Measurement of Reduction of Moisture Penetration through Horizontal Concrete Surfaces.

E. National Floor Safety Institute (NFSI): NFSI Test Method 101-A - Standard for Evaluating High-Traction Flooring Materials.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide polished flooring that has been designed, manufactured and installed to achieve the following:
1. Abrasion Resistance: ASTM C779, Method A, high resistance, no more than 0.008 inch (0.20 mm) wear in 30 minutes.
2. Reflectivity: Increase of 35% as determined by standard gloss meter.
3. Waterproof Properties: Rilem Test Method 11.4, 70% or greater reduction in absorption.
4. High Traction Rating: NFSI 101-A, ANSI B-101.1 2009 non-slip properties.

B. Design Requirements:
1. Hardened Concrete Properties:
a. Minimum Concrete Compressive Strength: 3500 psi (24 MPa).

b. Normal Weight Concrete: No lightweight aggregate.
c. Non-air entrained.

2. Placement Properties:
   a. Natural concrete slump of 4-1/2 inches to 5 inches (114 to 127 mm). Admixtures may be used.
   b. Flatness Requirements:
      1) Overall FF 50.
      2) Local FF 40.
3. Hard-Steel Troweled (3 passes) Concrete: No burnishing marks. Finish to ACI 302.1R, Class 5 floor.
   a. Class 6 floors, special colored mineral aggregate hardener with repeated hard steel trowel finish.
4. Curing Options:
   a. Membrane forming curing compounds (ASTM C309, Type 1, Class B, all resin, dissipating cure). 1) Acrylic curing and sealing compounds not recommended.
   b. Sheet membrane (ASTM C171); polyethylene film not recommended.
   c. Damp Curing: Seven day cure.

1.5 SUBMITTALS

A. Submit under provisions of Section 01 33 00 - Submittals.

B. Shop Drawings: Indicate information on shop drawings as follows:
1. Typical layout including dimensions and floor grinding schedule.
2. Plan view of floor and joint pattern layout.
3. Areas to receive colored surface treatment.
4. Hardener, sealer, densifier identified in notes.

C. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.
1. Material Safety Data Sheets (MSDS).
2. Preparation and concrete grinding procedures.
3. Colored Concrete Surface, Dye Selection Guides.

D. Quality Assurance Submittals:
1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties as cited in Performance Requirements.
2. Certificates:
   a. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
   b. Letter of certification from the National Floor Safety Institute confirming the system has been tested and passed phase Two Level of certification when tested by Method 101-A. ANSI B-101.1 2009 non-slip properties.
   c. Current contractor's certificate signed by manufacturer declaring Contractor as an approved installer of polishing system.
3. Manufacturer's Instructions: Manufacturer's installation instructions.

E. Warranty: Submit warranty documents specified.

F. Operation and Maintenance Data: Submit operation and maintenance data for installed products.
1. Manufacturer's instructions on maintenance renewal of applied treatments.
2. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer with a minimum of 5 years' experience in performing work of this section who has specialized in installation of work similar to that required for this project.
   2. Installer trained and holding a current certificate as a FGS PermaShine installer.
   3. Current Certification from the CPAA stating that the technicians are trained craftsmen.

B. Concrete finishing components and materials shall be from single manufacturer.

C. Manufacturer Qualifications:
   1. Manufacturer capable of providing field service representation during construction and approving application method.
   2. Manufacturer shall have a minimum 5 years of experience in manufacturing components similar to or exceeding requirements of project.

D. Regulatory Requirements: Comply with NFSI Test Method 101-A Phase Two Level High Traction Material.

E. Mock-Ups:
   1. Mock-Up Size: 100 sf (9.3 m2) sample panel at jobsite at location as directed under conditions similar to those which will exist during actual placement.
   2. Mock-up will be used to judge workmanship, concrete substrate preparation, operation of equipment, material application, color selection and shine.
   3. Allow 24 hours for inspection of mock-up before proceeding with work.
   4. When accepted, mock-up will demonstrate minimum standard of quality required for this work.
      a. Approved mock-up may remain as part of finished work.
   5. Mock-Up will demonstrate required level of cut:
      a. Level 1 - Cream Finish: Polishing only the Portland Cement paste at the surface without exposing small, medium or large aggregate. Note: If dye will be used, this is not an acceptable level of grinding. Go to Level 2.
      b. Level 2 - Salt/Pepper Finish: Expose the fine aggregate such as sand and small aggregate with the concrete. The depth of grind will depend greatly on the placement and finishing procedures. Generally, this level of cut can be achieved within 1/16" of the surface.
      c. Level 3 - Medium Aggregate: Exposing more of the overall girth of the coarse aggregate within the concrete. Generally, this level of cut can be achieved within 1/8" of the surface.
      d. Level 4 - Large Aggregate: Exposing the overall girth of the coarse aggregate within the concrete. This level of cut generally can be achieved within 1/4" of the surface.
      e. Sheen Level A: Sheen (glossy) as determined by a gloss reading of 45 - 60.
      f. Sheen Level B: Sheen (high gloss) as determined by a gloss reading of 60 - 70.
      g. Sheen Level C: Sheen (very high gloss) as determined by a gloss reading of 70 or higher.

F. Pre-installation Meetings: Conduct a pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Review the following:
   1. Environmental requirements.
   2. Scheduling and phasing of work.
   3. Coordinating with other work and personnel. Remind all trades that they are working on a surface that is to become a finished surface.
   4. Protection of adjacent surfaces.
   5. Surface preparation.
   6. Repair of defects and defective work prior to installation.

7. Cleaning.
8. Installation of polished floor finishes.
9. Application of liquid hardener, densifier.
10. Protection of finished surfaces after installation.
11. Placing of materials on the concrete surface that may cause staining, etching or scratching.

1.7 DELIVERY, STORAGE AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Protect Concrete Slab:
1. Protect from petroleum stains during construction.
2. Diaper hydraulic power equipment.
3. Restrict vehicular parking.
4. Restrict use of pipe cutting machinery.
5. Restrict placement of reinforcing steel on slab.
6. Restrict use of acids or acidic detergents on slab.

C. Waste Management and Disposal:
1. Separate waste materials for Reuse and Recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.
2. Remove from site and dispose of packaging materials at appropriate recycling facilities.

1.9 PROJECT AMBIENT CONDITIONS

A. Installation Location: Comply with manufacturer's written recommendations.

1.10 SEQUENCING

A. Sequence with Other Work: Comply with manufacturer's written recommendations for sequencing construction operations.

1.11 WARRANTY

A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and does not limit, other rights Owner may have under Contract Documents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: L&M Construction Chemicals, which is located at: 1 LATICRETE Park N.; Bethany, CT 06524-3423; Toll Free Tel: 800-362-3331; Tel: 402-453-6600; Email: request info (info@lmcc.com); Web:www.laticrete.com/lmcc

B. Substitutions: As Approved Equal

C. Requests for substitutions will be considered in accordance with provisions of Section 01 25 00 – Substitutions - Product Options.

2.2 POLISHED CONCRETE

A. Products/Systems:
1. Hardener, Sealer, Densifier: Proprietary, water based, odorless liquid, VOC compliant, environmentally safe chemical hardening solution leaving no surface film.
   a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Hardener Plus. Basis of design.
   b. Acceptable Material: L&M Construction Chemicals, Inc., Lion Hard may be substituted when conditions exist where disposing of rinse water is in conflict with local building codes.
2. Joint Filler: Semi-rigid, 2-component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with Shore A 80 or higher hardness.
   a. Acceptable Material: L & M Construction Chemicals, Inc., Joint Tite 750.
3. Oil Repellent Sealer: Ready to use, silane, siloxane and fluoropolymers blended water based solution sealer, quick drying, low-odor, oil and water repellent, VOC compliant and compatible with chemically hardened floors.
   a. Acceptable Material: L & M Construction Chemicals, Inc., Petrotex.
4. Concrete Dyes: Fast-drying dye, packaged in premeasured units ready for mixing with water or VOC exempt solvent; formulated for application to polished cementitious surfaces.
   a. Acceptable Material: L & M Construction Chemicals, Inc., Vivid Concrete Dyes or Vivid Dye WB Plus.
   b. Color: [_____].
5. Cleaning Solution: Proprietary, mild, highly concentrated liquid concrete cleaner and conditioner containing wetting and emulsifying agents; biodegradable, environmentally safe and certified High Traction by National Floor Safety Institute (NFSI).
   a. Acceptable Material: L & M Construction Chemicals, Inc., FGS Concrete Conditioner.
6. Stain Guard Sealer: Ready to use, is a low odor, VOC compliant, topical sealer consisting of low molecular emulsified cross-linking, coupling polymers that effectively protect concrete and other natural stone floor surfaces from the damaging effects of staining, defacing and deterioration due to contaminant penetration.
   a. Acceptable Material: L& M Construction Chemicals, Inc. Permaguard SPS.
7. Finish: Standard High gloss (HG-1), 1500 grit.
8. Finish: Medium gloss (MG-2), 800.
9. Finish: Very high gloss (VGH-3), 3000 grit.

PART 3 EXECUTION

3.1 EXAMINATION

A. Site Verification of Conditions:
1. Verify that concrete substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of concrete finishing materials.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify Concrete Slab Performance Requirements:
   1. Verify concrete is cured to 28 day duration and 3500 psi (24 MPa) strength.
   2. Verify concrete surfaces have received a hard steel-trowel finish (3 passes) during placement.
   3. Verify overall floor flatness is a minimum of Ff 40.

3.2 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter harmful to performance of concrete finishing materials.

B. Examine surface to determine soundness of concrete for polishing.

3.3 INSTALLATION

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions.

B. Floor Surface Polishing and Treatment:
   1. Provide polished concrete floor treatment in entirety of slab indicated by drawings. Provide consistent finish in all contiguous areas.
   2. Apply floor finish prior to installation of fixtures and accessories.
   3. Diamond polish concrete floor surfaces with power disc machine recommended by floor finish manufacturer. Sequence with coarse to fine grit. Installer to determine the optimum starting grit in order to achieve the specified aggregate exposure.
      a. Comply with manufacturer's recommended polishing grits for each sequence to achieve desired finish level. Following the initial passes of metal bond diamonds, the installer shall drop back a minimum of one grit level when transitioning to resin bond diamonds. The separation in grit designation shall be a minimum of 50 for the transitioning step. The installer shall refine each abrasive grit to its fullest potential before moving on to the next level. Floor shall be thoroughly scrubbed between each grit pass to remove all loose material. Level of sheen shall match that of approved mock-up.
      b. Expose aggregate in concrete surface only as determined by approved mock-up.
      c. All concrete surfaces shall be as uniform in appearance as possible.
   4. Dyed and Polished Concrete:
      a. Locate demarcation line between dyed surfaces and other finishes.
      b. Polish concrete to the 400 grit level, (200 grit for water based dyes).
      c. Apply pre-mixed dyes to polished concrete surface.
      d. Allow dye to dry.
      e. Remove residue with water and buffer pad; reapply as necessary for desired result.
   5. Hardener and Densifier Application:
      a. First coat of FGS Hardener Plus at 250 ft2/gal (6.25 m2/L), following the 400 grit level. (Lion Hard at 400-600 sq ft / gallon).
      b. Second coat of FGS Hardener Plus at 350 ft2/gal (8.75 m2/L), prior to the final polishing pass (Lion Hard at 600-800 sq ft / gallon).
      c. Follow manufacturer's recommendations for drying time between successive coats.

6. Remove defects and re-polish defective areas.
7. Finish edges of floor finish adjoining other materials in a clean and sharp manner.

3.4 ADJUSTMENTS

A. Re-polish those areas not meeting specified gloss levels per mock-up.

B. Fill joints flush to surface prior to the start of polishing operations.

3.5 FINAL CLEANING

A. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

3.6 PROTECTION

A. Protect installed product from damage during construction in accordance with manufacturer's recommendations.

END OF SECTION

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SECTION 04 22 00

CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Reinforcing steel.
3. Mortar, grout and grouting.
4. Bolts, anchors, hardware, metal frames, and other insert items.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4200 - Testing and Inspection.
3. Section 03 1000 - Concrete Forming and Accessories.
4. Section 03 2000 - Concrete Reinforcing.
5. Section 03 3000 - Cast-In-Place Concrete.
6. Section 05 1200 - Structural Steel Framing.

1.2 REFERENCES

A. American Society for Testing and Materials International (ASTM):

1. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
2. ASTM C90 - Standard Specification for Load Bearing Concrete Masonry Units.
3. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
4. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
5. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
8. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
9. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
10. ASTM C426 - Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
11. ASTM C476 - Standard Specification for Grout for Masonry.
12. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
13. ASTM C1019 - Standard Test Method for Sampling and Testing Grout.
14. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms.
15. ASTM C1586 – Standard Guide for Quality Assurance of Mortars.

B. Masonry Standards Joint Committee (MSJC), the Masonry Society (TMS), American Concrete Institute (ACI) and American Society of Civil Engineers (ASCE).

1. TMS 602/ACI 530.1/ASCE 6 – Specification for Masonry Structures.
2. TMS 402/ACI 530/ASCE 5 – Building Code Requirements for Masonry Structures.

1.3 SUBMITTALS

A. Mix Design: Submit grout and mortar mix designs. Mix designs shall be signed and sealed by a Civil or Structural Engineer registered in the State of California.

B. Product Data: Submit manufacturer's Product Data for assembly components, materials, and accessories. Submit certificates and data assuring that the proposed materials meet the specified ASTM standards.

C. Samples: Submit Samples for each type of required masonry unit, including reinforcement and accessories.

D. Shop Drawings: Indicate wall reinforcement, splice locations and bending diagrams.

E. Admixtures: Additives and admixtures to mortar and grout shall not be used unless approved by the enforcing agency. Submit product data for any proposed admixture.

1.4 REGULATORY REQUIREMENTS

A. Perform the Work in accordance with CBC, Chapter 21A.

B. Comply with requirements of TMS 602.

1.5 QUALITY ASSURANCE

A. Comply with the requirements of Section 01 4200 - Testing and Inspection.

B. Concrete Masonry Units:

1. Notify the testing laboratory a minimum of 45 days in advance of installing concrete unit masonry, to allow for preconstruction testing of the units.

   a. Units will be sampled and tested in accordance with ASTM C140 for compressive strength, absorption and moisture content.
   b. Units will be sampled and tested in accordance with ASTM C426 for linear drying shrinkage.

2. The material testing laboratory shall receive concrete masonry unit specimens for testing from masonry unit manufacturer. Number of specimens shall be as indicated in referenced ASTM standard tests. Testing laboratory will perform and send test results to the ARCHITECT and Project Inspector.

C. Portland Cement: Submit certification from the cement manufacturer that the cement proposed for use on the project has been manufactured in accordance with ASTM C150. Certification shall include test results made on cement samples during production.

D. Mortar and Grout Tests: Prior to the beginning of masonry work, mortar and grout will be tested, unless prism tests will be performed as indicated below.

1. Mortar: Shall conform to ASTM C270 Table 2 for Type S mortar.

   a. Provide qualifications of mortar as meeting ASTM C270 at the beginning of the job and whenever mix design is changed.
   b. Mortars will be evaluated during preconstruction and tested during construction for proportioning or compressive strength in accordance to ASTM C780.

2. Grout: Shall conform to ASTM C476, and will be tested in accordance with ASTM C1019. Compressive strength shall equal or exceed specified compressive strength (*f'm*) at 28 days, but not less than 2,000 psi.

   a. Ready-Mix Grout: Grout manufacturer shall furnish batch ticket information in accordance to ASTM C94.

E. Prism Test: The compressive strength of concrete masonry will be determined by the prism test method prior to the start of construction and during construction.

F. Masonry Core Testing: Core testing will be performed in accordance with CBC, Section 2105A.4.

G. Inspection During Installation: A special inspector will continuously observe the installation of reinforced masonry. The Project Inspector shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

H. OWNER will be responsible for the costs of original tests and inspection.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store units above grade on level platforms or pallets, in a dry location.

B. Store cementitious materials and aggregates in such a manner as to prevent deterioration or intrusion of foreign matter or moisture.

C. Handle units on pallets or flat bed barrows. Free discharge from conveyor units or transportation in mortar trays is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete Unit Masonry: Modular medium weight conforming to ASTM C90, hollow load-bearing concrete unit masonry. Masonry units shall meet the minimum compressive strength requirements of ASTM C90, or as indicated on project drawings, whichever is greater.

1. Concrete masonry unit sizes shall be as indicated on the drawings.
2. Provide open-end units at walls to be fully grouted.
3. Provide closed-end units at walls and at openings where ends will be exposed in finish Work; provide bond beam blocks where horizontal reinforcement is indicated.
4. Provide special shapes and accessory units at locations indicated on Drawings.
5. Provide units in colors and textures as indicated in the drawings.
6. Masonry unit shall have been cured for a minimum of 28 days.
7. Masonry unit shall have maximum liner shrinkage of 0.065 percent from saturated to oven dry.

B. Portland Cement: ASTM C150, Type II, from one source.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates: ASTM C144 for mortar and ASTM C404 for grout.

E. Mortar: ASTM C270, Type S, conforming to the property specifications of CBC Table 2103A.8 (2).

F. Grout: ASTM C476.

G. Admixture for Grout: Grout Aid, as manufactured by Sika Chemical Corp., or equal.

H. Water: Clean, potable, free from substances deleterious to mortar, grout or reinforcement.

I. Reinforcing Steel: Provide and install reinforcing steel in accordance with Section 03 2000 - Concrete Reinforcing.

J. Cleaning Materials: Sure Klean No. 600 detergent by ProSoCo.

K. Miscellaneous Materials: As required to complete the Work.

L. Anchor Bolts: Shall be hex headed bolts conforming to ASTM A307 Grade A with the dimensions of the hex head conforming to ANSI/ASME B18.2.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Discard units with cracks or other defects not complying with requirements of ASTM C 90.

3.2 CONSTRUCTION

A. Construct per applicable provisions of CBC and TMS 602.

B. Conform to TMS 602 for hot and cold weather masonry construction.

3.3 MORTAR AND GROUT MIXING

A. Mortar: Shall be type S per ASTM C270 and shall comply with 2019 CBC Section 2103A.9. Mortar shall have a minimum 28-day strength of 2000psi for f'm=2000psi and 2500psi where f'm=2500psi.

B. Grout: Shall comply with 2019 CBC Section 2103A.13 of the code and ASTM C476. Grout shall have a minimum 28-day compressive strength of 2500psi for f'm=2000psi. Grout space requirements

for coarse and fine grouts shall be per TMS 602 Table 6. Add Sika Chemical Corp. Grout Aid per manufacturer's instructions.

C. Measurements: Measure in calibrated devices that can be checked at any time.

1. Add water for workable consistency.
2. Shovel measurements are not permitted.

D. Mixing: Mix in accordance to TMS 602.

1. Mortar: Mix cementitious materials and aggregates between three and five minutes in a mechanically operated mixer. Mix dry ingredients with a sufficient amount of water to provide a workable mix. Batches of less than one sack of cement, and fractional sack batches are not permitted.
2. Factory Blended Mortar: Mix in accordance with manufacturer's recommendations.
3. Grout: Add sufficient water for a workable mix that will flow into all voids of the masonry without separation or segregation. Grout slump shall be between 8 and 11 inches.

E. Re-tempering Time Limit: Use mortar within 2 ½ hours after mixing. Discard any mortar that has been mixed longer or that has begun to set. If necessary re-temper within this time limit, by replacing only water lost due to evaporation and by thoroughly remixing.

3.4 INSTALLATION OF MASONRY UNITS

A. Workmanship: Install masonry plumb and true to line with straight level joints of uniform thickness. Comply with TMS 602 tolerances. Maintain masonry clean during and after installation.

1. Lay-out and incorporate embedded hardware items.
2. Assist other trades with built-in items, which require cutting and fitting of masonry.
3. Cut block units with a diamond saw or carborundum wheel. Trowel or chisel cutting is not permitted.
4. Keep cavities clear of droppings and debris. Remove droppings prior to grouting.

B. Reinforcing Steel: Install as indicated on Drawings. Except as otherwise indicated, install reinforcement in accordance with standards of Concrete Reinforcing Steel Institute and to requirements specified in Section 03 2000 - Concrete Reinforcing. Do not splice vertical reinforcement except where indicated on the Drawings.

C. Shoring: Provide temporary shoring for lintels with sufficient strength to carry load without deflecting. Remove temporary shoring not less than 28 days after masonry has been installed.

D. Block Installation: Clean dirt and dust from surfaces before installation. Do not wet masonry units.

1. Foundation preparation: Clean top surface of concrete foundation of dirt, projections and laitance before starting masonry construction. Wet saw cutting of units immediately prior to laying is permitted.
2. Install masonry with mortar to required joint thickness. Install blocks with 3/8-inch mortar bed. Fill head joints solid, install tightly to adjoining units. Provide 3/8-inch joint thickness.

    a. Hold racking to a minimum.
    b. No toothing is permitted.
    c. If it becomes necessary to move a unit after it has been installed, remove the unit, discard the mortar, and install the unit in fresh mortar.

3. Anchor Bolts: Provide 1/2-inch minimum grout space between bolts and masonry.
4. Bond: Unless otherwise indicated, install units in common running bond.
5. Finish Joint Treatment: Unless otherwise indicated, cut both interior and exterior joints flush, and tool slightly concave to a dense, uniform surface.
6. Grouting: Unless noted otherwise on Drawings, completely fill cells with grout.

E. Steel Door Frames:

1. Locate door frames accurately, install plumb, Set frames to floor with powder driven or expansion anchors (as indicated on the drawings) to floor surface and brace in position before start of masonry installation.

a. Frames are specified to be furnished with adjustable anchors.
b. Fill interior of frames solid with mortar or grout as walls are constructed.

2. Provide temporary wood spreaders from jamb to jamb and from head to floor to ensure that jambs do not bow-in, distort from a straight line, or deflect from superimposed loads during construction.

3.5 GROUTING

A. Prior to grouting all cells shall be cleaned so that all spaces to be filled with grout do not contain mortar projections greater than 1/4 inch, loose mortar or foreign material.

B. Grout materials and water contents shall be controlled to provide adequate fluidity for placement without segregation of the constituents, and shall be mixed thoroughly. Reinforcement shall be properly positioned and solidly embedded in the grout.

C. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.

D. Between grout pours, a horizontal control joint shall be formed by stopping all wythes at the same elevation and with the grout stopping at 1 ½ inches below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be stopped a minimum of ½ inch below the top of the masonry.

3.6 LOW-LIFT GROUTING FOR HOLLOW MASONRY UNITS

A. Grouting shall meet the requirements of CBC Section 2104A.1.3.

B. After mortar joints have set, cells are cleaned of mortar and debris, and reinforcement is installed and inspected, grout cells in 4-foot maximum lifts. Horizontal and vertical reinforcement shall be held in place within permitted tolerances by suitable devices.

C. Grout may be installed by pump, tremie or bucket, using hoppers to avoid spilling on exposed surfaces.

D. All grout shall be consolidated and reconsolidated with a mechanical vibrator after placing so as to completely fill all voids and to consolidate the grout. Grouted walls shall be solid and without voids.

3.7 HIGH-LIFT GROUTING OPTION FOR HOLLOW MASONRY UNITS

A. Grouting shall meet the requirements of CBC Section 2104A.1.3 and DSA IR 21-2.

B. High-lift grouting shall apply only to cell sizes available with 8 inch and wider block units. This method is subject to approval of the Division of the State Architect (DSA).

C. Provide bond beam units, inverted for start course, and omit alternate blocks or remove entire face shell of every other unit to allow access to all cells on bottom course for cleanouts.

D. Plug each cleanout by setting a face shell in mortar into opening and securely bracing it in place to prevent displacement. If masonry is not exposed in finish Work, cleanouts may be formed.

E. Grouting: Grouting shall be done in a continuous pour in lifts not exceeding 5-foot in height. The grouting of any section of a wall between control barriers shall be completed in one day, with no interruptions greater than one hour.

F. Consolidating: Grout shall be consolidated by mechanical vibration only, and shall be reconsolidated after excess moisture has been absorbed, but before plasticity is lost. Vibrating of reinforcing steel is not permitted.

3.8 CURING

A. Remove efflorescence, stains, debris, excess grout, and foreign matter.

B. During curing, or for any other purpose, do not saturate masonry with water.

3.9 PARGE COAT

A. Apply parge coat to the earth side of surfaces that are to receive waterproofing.

B. A Portland cement and sand mix (1:3.5 by volume) or Type S mortar may be used for the parge coat.

C. Parging should be applied to damp (not saturated) concrete masonry in two 1/4 inch thick layers. The first coat should be roughened when partially set, hardened for 24 hours, and then moistened before second coat is applied. The second coat should be trowelled to a smooth, dense surface.

D. The parge coat should be beveled at the top to form a wash, and thickened at the bottom to form a cove between the base of the wall and the top of footing.

3.10 CLEANING

A. At completion of masonry Work, remove misplaced mortar, grout or other foreign substances, and clean surfaces which will be exposed in finish Work with specified cleaner, or with clean water and stiff fiber brushes.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section

B. Section Includes:

1. Structural steel.

C. Related Sections:

1. Section 01 4200: Testing and Inspection
2. Section 05 3000: Metal Decking
3. Section 05 5000: Metal Fabrications
4. Section 09 9600: High Performance Coatings

1.2 REFERENCES

A. California Building Code (2019 CBC), Chapter 22A, 2019 Edition.

B. AISC Standards – AISC 303-10 - Code of Standard Practice for Steel Buildings and Bridges; AISC 360-16 - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings; AISC AWS Standards - AWS D1.1, Structural Welding Code, latest Edition.

C. Structural Joint Reference Specification - The Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts established by the Research Council On Riveted and Bolted Structural Joints of the Engineering Foundation, hereinafter referred to as "Ref Spec".

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit Shop Drawings, including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection. Fully detail minor connections and fastenings not shown or specified in the Contract Documents to meet required conditions using similar detailing as shown in the Contract Documents. Include a fully detailed, well controlled sequence and technique plan for shop and field welding that minimizes locked in stresses and distortion; submit sequence and technique plan for review by the Architect.

a. Include details of cuts, connections, camber, and holes in accordance with Figure 4.5 of AWS D1.1 or AISC 360 Section J1.8, weld position plan and other pertinent data. Indicate welds by standard AWS symbols, and show size, length and type of each weld.
b. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed for Work specified in other sections.
c. Erection and Bracing Plan and Erection Procedure: Submit an erection and framing plan, including columns, beams, and girders, prepared, signed and sealed by a structural engineer registered in the State of California in accordance with Title 8 CCR, Section 1710. Maintain a copy at the Project site as required by the California Division of Industrial Safety.
d. Submit a list of steel items to be galvanized.
e. Include identification and details of Architecturally Exposed Structural Steel (AESS) members.

B. Product Data:

1. Submit copies of fabricator's specifications and installation instructions for the following products. Include laboratory test reports and other data required demonstrating compliance with these Specifications:

    a. Structural steel, each type; including certified copies of mill reports covering chemical and physical properties.
    b. Welding electrodes.
    c. Welding gas.
    d. Unfinished bolts and nuts.
    e. Structural steel primer paint.
    f. High-strength bolts, including nuts and washers.

C. Manufacturer's Mill Certificate: Submit, certifying that products meet or exceed specified requirements.

D. Mill Test Reports: Submit manufacturer's certificates, indicating structural yield and tensile strength, destructive and non-destructive test analysis.

E. Submit certified copies of tests by manufacturer for fine grain practice. Structural steel base material, as described above, shall be manufactured using fully killed fine grain practice having grain size number 5 or better as determined by ASTM E 112.

F. Weld Procedures: Submit weld procedures for all connections. Weld procedures shall be prequalified or qualified as described in AWS D1.5, Section 5.12 or 5.13 for self shielded FCAW, Weld procedures shall indicate joints details and tolerances, preheat and interpass temperature, post-heat treatment, single or multiple stringer passes, peening of stringer passes for groove welds except for the first and the last pass, electrode type and size, welding current, polarity and amperes and root treatment. The welding variables for each stringer pass shall be recorded and averaged, from these averages the weld heat input shall be calculated. Welding shall not proceed until WPS have been reviewed and approved by the Engineer of Record and DSA.

G. Welder's Certificates: Field welders shall be Project certified in accordance with AWS D1.1. Shop welders shall be Project certified for FCAWS in accordance with AWS D1.1.

H. Test Reports: Submit reports of tests conducted on shop and field welded and bolted connections. Include data on type of test conducted and test results.

1.4 QUALITY ASSURANCE:

A. Comply with the following as a minimum requirement:

1. California Building Code, 2019 Edition, Chapter 22A, specifically sections 2212A & 1705A.
2. AISC Standards – AISC 303-05 - Code of Standard Practice for Steel Buildings and Bridges; AISC 360 - Specification for the Design, Fabrication and Erection of Structural Steel for Buildings; AISC 341-05 – Seismic Provisions for Structural Steel Buildings; AISC 358-05 – Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications.
3. AWS Standards- AWS D1.1, Structural Welding Code.
4. Structural Joint Reference Specification - The Specifications for Structural Joints Using ASTM A325 or ASTM A490 Bolts established by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation, hereinafter referred to as "Ref Spec".
5. Structural steel shall conform to CBC requirements, except that steel manufactured by acid Bessemer process is not permitted for structural purposes.
6. Sheet and strip steel other than those listed in CBC, if provided for structural purpose, shall comply with DSA requirements.
7. Architecturally Exposed Structural Steel (AESS)

    a. Steel members exposed to view in the final condition to building users other than maintenance staff shall be fabricated and erected according to AISC Code of Standard Practice Section 10 with the following exceptions.

1) Tolerance for as-fabricated straightness and as-erected plumbness, levelness and alignment shall be standard AISC tolerances. No special tolerances area required for AESS members.

B. Qualifications of Fabricator: Fabricate structural steel in shop of a licensed fabricator, AISC certified, in the same category of the scope of this project. City of Los Angeles certification in lieu of AISC certification is acceptable.

C. Requirements of Regulatory Agencies: Work of this Section shall conform to Title 8 CCR and to Subparagraph 1.2.A above.

D. Source Quality Control: Refer to Section 01 45 00. Testing Laboratory shall perform conformance testing in accordance with 2019 CBC Section 2212A.

1. Identified Structural Steel: Tests are waived for steel identified by heat number, accompanied by mill analyses and mill test reports, and properly tagged with an Identification Certificate so as to be readily identified for conformance with applicable ASTM. Comply with 2019 CBC Section, 2212A and/or 1704A.
2. Unidentified Structural Steel: Steel not identified and certified as specified above shall be tested according to following requirements. Structural steel fabricator shall cut samples under direction of the Special Inspector and Testing Laboratory shall machine or otherwise prepare the specimens and perform testing of each 5 tons or fraction thereof for each size of unidentified steel except, in the case of random pieces or of steel having Fy greater than 36 Ksi, testing of each piece is required. Tests required are:

   a. For pipe, one tension and elongation test and one flattening test for each size.
   b. For all other steel, one tension and elongation test and one bend test for each size.
   c. Contractor shall reimburse to Owner all costs paid by Owner for testing unidentified steel.

3. Testing of High Strength Bolts, Nuts, and Washers: According to 2019 CBC Section 2212A.1.

E. Erection and Bracing Plan and Procedure: Refer to Section 1710, Title 8, CCR, and Building Code. Employ and pay a California registered civil engineer to prepare an erection and bracing plan and erection procedure for structural steel including columns, beams, and girders, who shall be solely responsible for its compliance. Follow the plan and procedure exactly. Keep a copy at the job site as required by California Division of Industrial Safety. File two copies of stamped erection and bracing plan and procedure for record purposes only, not for review or approval.

F. Testing & Inspection shall comply with the following:

1. EXCEPTION: No mechanical tests are required for unidentified steel when the minimum yield stress required by the design is less than or equal to 25 ksi (172 Mpa) and the steel is not part of the designated lateral-force-resisting system.
2. 2019 CBC Section 2212A.1 Tests of High-strength Bolts, Nuts and Washers. High-strength bolts, nuts and washers shall be sampled and tested by an approved independent testing laboratory for conformance with the requirements of Division III.
3. 2019 CBC Section 2212A.2 Tests of End-welded Studs. End-welded studs shall be sampled, tested and inspected per the requirements of the Structural Welding Code – Steel, published by the American Welding Society.
4. 2019 CBC Section 1704A.3.1.4 Inspection of Welding. Inspection of all shop and field welding operations, including the installation of automatic end-welded stud shear connectors shall be made by a qualified welding inspector approved by the enforcement agency. Such inspector shall be a person trained and thoroughly experienced in inspecting welding operations. The inspector's ability to distinguish between sound and unsound welding shall be reliably established. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the ANSI/AWS QCI-1-96, Standard for AWS Certification of Welding Inspectors published by the American Welding Society. All welding inspectors shall be approved by the enforcement agency.
5. The ability of each welder to produce sound welds of all types required by the work shall be established by welder qualification satisfactory to the enforcement agency.

6. Welding inspection of structural welding shall conform to the requirements of AWS D1.1 Structural Welding Code – Steel, published by the American Welding Society, except as modified by this section.
7. Welding inspection of cold-formed steel members shall conform to the requirements of AWS D1.3.
8. The welding inspector shall make a systematic record of all welds. This record shall include in addition to other required records:

    a. Identification marks of welders.
    b. List of defective welds.
    c. Manner of correction of defects

9. The welding inspector shall check the material, equipment, details of construction and procedure, as well as the welds. The inspector shall also check the ability of the welder. The inspector shall verify that the installation procedure for automatic end-welded stud shear connectors is in accordance with the requirements of AWS D1.1, Structural Welding Code – Steel, published by the American Weld Society and the approved plans and specifications. The inspector shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding is proper and has been done in conformity with AWS D1.1, Structural Welding Code – Steel, published by the American Welding Society and the approved plans and specifications. The inspector shall use all means necessary to determine the quality of the weld. The inspector may use gamma ray, magnaflux, trepanning, sonics or any other aid to visual inspection, which the inspector may deem necessary to be assured of the adequacy of the welding.
10. EXCEPTION: Plant welding inspection of open-web steel joists may be waived with the approval of the enforcement agency where welding inspection is provided at the jobsite.
11. 2019 CBC Section 1704A.3.3 Inspection of High Strength Bolt Installations. Inspection of high-strength bolt installations shall be made by an inspector specially approved for that purpose by the enforcement agency. The inspector shall check the materials, equipment, details of construction and installation procedure. The inspector shall furnish the architect, structural engineer and the enforcement agency with a report that the work has been completed in every material respect in compliance with the approved plans and specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store structural steel above grade on platforms, skids or other supports.

B. Protect steel from corrosion.

C. Store welding electrodes in accordance with AWS D 12.1. Deliver electrodes to the site in unbroken packages bearing the manufacturer's name and label identifying the contents.

D. Store other materials in a weathertight and dry place until installed into the Work.

1.6 PROJECT SITE CONDITIONS

A. Site Measurements: Take field measurements as required. Report any major discrepancy between Drawings and field dimensions.

B. Protection of Floors: Use caution to protect floor slab and adjacent Work from damage. Do not overload floors. Use rubber tired equipment to handle and move steel. Do not place steel members directly on floor; use pads of timber or like material for cushioning.

C. Temporary Flooring: Provide necessary temporary planking, scaffolding, and flooring for erection of structural steel or support of erection machinery. Conform use of temporary floors or steel decking to Code.

D. Connection of Steel Decking Temporary Flooring: Temporarily weld steel decking to supports where used as a working platform. Distribute concentrated loadings from welding machines and other heavy machinery with planking or equal. Replace decking damaged by use as a working platform at no additional contract cost.

PART 2 - PRODUCTS

2.1 GENERAL

A. Stock Materials: Provide exact materials, sections, shapes, thickness, sizes, weights, and details of construction indicated on Drawings. Changes because of material stock or shop practices will be considered if net area of shape or section is not reduced thereby, if material and structural properties are at least equivalent, and if overall dimensions are not exceeded.

2.2 MATERIALS

A. Steel shapes: ASTM A992, or ASTM A572 GR 50.

B. Steel plates: ASTM A36 and A572-GR50 as noted on drawings.

C. Steel tubing: ASTM A500, Grade B, Fy = 46 ksi.

D. Steel pipe: ASTM A120 standard weight for general use; ASTM A53 Grade B where used for structural purposes.

E. Bolts and nuts: ASTM A307.

F. High-strength bolts, nuts, and washers: ASTM A325 or ASTM A490 as indicated for the bolts, ASTM A563 Grade C for nuts, and ASTM F436 for carburized washers. All high-strength bolts shall have a suitable identifying mark placed on top of bolt head at the factory. Refer to drawings for bolt specification requirements.

G. Anchor Bolts: ASTM A36, A307,A354, or F-1554 bolts as specified per contract documents.

H. Electrodes: AWS D5.1, E70XX Series Low Hydrogen Electrodes as required for intended use. All electrodes shall have a minimum Notch -Toughness of 20 FT-Lb at -20 degree F.

I. Primer: Use types acceptable to governing air quality management officials.

1. For above-grade locations: See Section 2.03, J, Shop Finish, Item 4.
2. For below grade applications: Coal-tar epoxy coating, two coats, 5 mils per coat. Perma Bar, as manufactured by Karlee Co., Burbank, CA, or equal. Touch-up on job site with Perma-Bar coal-tar epoxy, match finish coat thickness.

J. Non-shrink grout: Master Builders "Embeco 636", or equal, non-gas-forming, free of oxidizing catalysts and inorganic accelerators, performance and characteristics when mixed to a fluid consistency meeting CRD-C 79 and CRD-C 588, non-staining type in exposed areas.

K. Clevis & Turnbuckle materials to be C-1035 and shall have the capacity to resist loads equal to or greater than those specified in the Manual of Steel Construction – Allowable Stress Design, Ninth Edition Tables on 4-148 & 4-149. Supply Structural Engineer of Record evidence of conformance to the specified classifications and capacities.

2.3 FABRICATION

A. Cleaning and Straightening: Thoroughly wire brush material, clean of loose mill scale and rust, and straighten by methods that will not injure the steel prior to fabrication. Remove twists or bends after punching or working component parts of a member before the parts are assembled. Produce finished members free from twists, bends, and open joints when erected.

B. Contact: Pin components parts of built-up members and maintain in close contact using clamps or temporary bolting during welding operations. Accurately mill compression bearing surfaces of joints depending on contact bearings or saw cut square to axis, or as detailed. Cut other joints straight and true.

C. Joining: Provide members of the sizes, weights, shapes, and arrangements indicated, closely fitted and finished true to line and in precise position as necessary to allow proper joining of parts in the field. Drifting to enlarge unfair holes is not allowed without prior approval.

D. Drilling, Punching, and Reaming: Hole burning to make or enlarge previous holes is allowed only with prior approval. Prepare required holes in structural steel members for attachment or passage of Work of other trades. Precisely locate finished holes to ensure passage of all bolts through steel assemblies without drifting. Enlarge holes only by reaming. Poor matching of holes is cause for rejection.

E. Holes For Anchor Bolts: Punch and drill or ream holes in base and bearing plates. Do not make or enlarge the holes by burning except for grouting holes in column bases without prior approval by the Architect.

F. Gas Cutting: Use of a cutting torch is allowed where the metal being cut is not stressed during the operation, and provided stresses are not transmitted through a flame-cut surface. Make all gas cuts with a smooth regular contour. Deduct 1/8" from width of gas cut edges to determine effective width of members that are gas cut. Make radius of reentrant gas cuts as large as possible, but 1" minimum.

G. Comply with applicable provisions of AISC “Code of Standard Practice”, Section 10 “Architecturally Exposed Structural Steel (AESS)” for all exposed structural steel.

H. Galvanizing: After fabrication, items indicated or specified to be galvanized shall be galvanized in largest practical sizes. Fabrication includes operations of shearing, punching, bending, forming, assembling or welding. Galvanized items shall be free from projections, barbs, or icicles resulting from the galvanizing process.

I. Welding:

1. Type of steel furnished in welded structures shall provide chemical properties suitable for welding as determined by chemical analysis. Welds shall conform to the requirements of 2019 CBC Chapter 17A.
2. Materials and workmanship shall conform to the requirements specified herein and to 2019 CBC requirements, modified as follows:
    a. No welded splices shall be permitted except those indicated on Drawings unless specifically reviewed by the Architect.
    b. Drawings will designate joints in which it is important that welding sequence and technique be controlled to minimize shrinkage stresses and distortion.
3. Welding shall be performed in accordance with requirements of the AWS Structural Welding Code.
4. Architecturally Exposed Structural Steel: Verify that weld sizes, fabrication sequence, and equipment used for Architecturally Exposed Structural Steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds ½ inch and larger. Grind flush butt welds. Dress exposed welds.
5. Remove erection bolts on welded, Architecturally Exposed Structural Steel; fill holes with plug welds; and grind smooth at exposed surfaces.

J. Shop Finish:

1. Notify the IOR when Work is ready to receive shop prime coat. Work shall be inspected by the IOR before installation of primer.
2. Structural steel and fittings, except galvanized items, shall receive a coat of primer. Refer to Section 09 9600 for high performance coating requirements on exposed steel and below Item 4.
3. The primer specified shall be spray applied, filling joints and corners and covering surfaces with a smooth unbroken film.
4. Cleaning and priming of exposed exterior and interior steel members and concealed members located outside exterior weatherproofing envelope:
    a. Preparation: Clean by SSPC SP6 - Commercial Blast Cleaning. Work primer into joints. Do not prime the following:
        1) Steel surfaces embedded in concrete or masonry with the exception of those steel surfaces that support anchored brick veneer.

2) Contact surfaces of high-strength bolted connections or field welded connections.
3) Surfaces to receive directly adhered fireproofing.

b. Primer: Organic Urethane Zinc Rich conforms to SSPC Paint 20 type II and with the requirements of AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts" for a Class B Coating by testing method to determine the slip coefficient for coatings used in bolted connections. Products known to comply include the following: Tnemec Company: 90-97 Tneme-Zinc @ 2.5 to 3.5 mils DFT.

c. Do not paint within 2 inches of field welds and on contact surfaces of slip critical connections.

d. Clean and paint surfaces inaccessible after shop assembly prior to assembly.

K. Fabricate Architecturally Exposed Structural Steel with exposed surfaces smooth, square, and free of surfaces blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating and shop priming.

2. Comply with fabrication requirements, including tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for Architecturally Exposed Structural Steel.

L. Architecturally Exposed Structural Steel: use special care in unloading, handling and erecting the steel to avoid marking or distorting the steel members. Minimize damage to any shop paint when temporary braces or erection clips are used. Avoid unsightly surfaces upon removal. Grind smooth tack welds and holes filled with weld metal or body solder. Plan and execute all operations in such a manner that the close fit and neat appearance of the structure will not be impaired.

2.4 CONNECTIONS:

A. Make connections with bolts as noted on the Structural Drawings.

B. High-Strength Steel Bolting: For joints connected by high strength steel bolts, hardened washers, and nuts tightened to high tension, conform materials, method of installation and tension control, and wrenches to Reference Standards and 2019 CBC Chapter 22A, Division III. Install all high-strength bolts under inspection required by 2019 CBC Section 1704A.3.3.

1. Connections shall be the "bearing bolt type" (A325-N) unless noted to be "slip-critical" (A325-SC and A490-SC). Refer to drawings. All bolts of Seismic Load Resisting System (SLRS) shall be pretensioned meeting the requirements for slip critical fraying surfaces in accordance with AISC 360-05, Section J3.8 with a class 'A' surface per section 7.2 of AISC 341-05.
2. Bolt lengths shall be the grip plus 1 1/4".
3. Tightening of nuts shall be done with properly calibrated wrenches or by the turn-of-the-nut method for A325-SC and A490-SC bolts. Tightening of the nuts for A325-N bolts to snug tightness shall be to Ref. Spec. Allowable bolt stresses shall conform to 2019 CBC Chapter 22A and referenced standards.
4. Check calibrated wrenches individually for accuracy not less than once daily for actual conditions of application.
5. Clean all contact surfaces of bolted parts and threads free of scale, slag, burrs, pits, dirt, paint, and other foreign material or defects which would prevent solid seating of connected parts.
6. Install hardened washers per AISC Standards and 2019 CBC Chapter 22A.
7. Tighten bolts systematically from most rigid part of connection to the free edges.
8. Retighten first installed bolts that may have loosened by tightening of subsequent bolts so all bolts are tightened to correct tension.
9. Mark fully tightened bolts with identifying symbol.
10. The contractor shall torque test 25% of the bolts in connections designated with A325-SC or A490-SC Bolts.

C. Load Indicator Washers: As manufactured and licensed by Cooper and Turner, Bethlehem Steel, or approved equal, may be used for the field installation of the high-strength bolts. Load indicator washers may not be substituted for any required washer, but may be used in conjunction with the required washers. Conform tightening to Paragraph 5e of the Reference Spec listed under Section 1.2 . After sufficient bolts in a joint are snugged to bring the members into close contact, tightening shall progress from the most rigid part to the free edges until the load indicators on all bolts are closed to the required gap of 0.015" under bolt heads or 0.010" under the nuts. Do not completely close the gap to prevent overtightening and damage to the bolts. Conform to ASTM F959, A325 and A490.

D. Tension Set or Load Indicator Bolts, Nuts, and Washers: As manufactured by Cold Form Specialties, Bethlehem Steel, or approved equal, may be used for field installation of the high-strength bolts. In multi-bolt joints, the nuts shall be tightened in stages (a little at a time) without breaking the spline in any of them until the final stage, to minimize slackening of the installed bolts.

2.5 WELDING:

A. Conform to 2019 CBC Section 1704A.3.1.4, AWS D1.1 as modified by referenced AISC Standards, and as indicated or noted on Drawings. Employ welding operators qualified in accordance with AWS D1.1, as applicable, who are thoroughly trained and experienced in arc welding and that produce uniformly reliable groove and fillet welds in flat, vertical, and overhead positions, and make neat and consistent welds. Weld all structural steel joints by shielded electric-arc method unless otherwise shown, specified, or approved. Conform welding in both shop and field, including the prequalification of welds and welder qualifications, to AWS D1.1.

B. Storage and Care of Electrodes: Coatings of low-hydrogen type electrodes shall be thoroughly dry as used. Conform to AWS D1.1; use electrodes as taken from hermetically sealed packages within time limit specified therein after package is opened. Electrodes not used within allowable time period and electrodes that have been exposed more than one hour to air having a relative humidity of 75% or greater, or as required by the manufacturer, shall be dried according to AWS D1.1 before they are used, or shall be reconditioned according to electrode manufacturer's recommendations. Electrodes so dried or reconditioned not used within allowable time period after drying is completed shall be redried before use. Electrodes of any class that have been wet shall not be used under any conditions.

C. Preparation: Clean steel surfaces to be welded of all paint, grease, oil, mill scale, and foreign matter. Clean weld each time the electrode is changed. Chip full surface of hand guided and controlled flame cut edges before welding. Surfaces prepared with automatic or mechanically guided and controlled equipment need not be ground or chipped before welding.

D. Weld Finishing: Grind exposed welds subject to contact to smooth surfaces free of holes, slag, or other defects, flush with the adjoining surfaces. No finish treatment is required for permanently concealed welds and other exposed welds.

E. Procedures: During assembling and welding, hold components of a built-up member with adequate clamps or other means to keep parts straight and in close contact. Do no welding in wind until adequate protective screening is set up. Cut out defective welds or parts of welds with a chisel or air arc and replace.

F. Weld Characteristics: Conform to AWS D1.1, Chapter 8, Statically Loaded Structures. Clean and wire brush all welds. Visual inspection of finished welds must show uniform section, smoothness of welded metal, feather edges without undercuts or overlays, freedom from porosity and inclusions, and good fusion and penetration into base metal at edges and ends of fillet welds.

2.6 SHOP AND FIELD QUALITY CONTROL

A. A special inspector, approved by DSA to inspect the Work of this section, shall inspect high-strength bolted connections. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with 2019 CBC 2212A and 1704A. The IOR shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

B. An AWS CWI certified special inspector, approved by DSA to inspect the Work of this section, shall inspect welded connections. The Owner will provide a DSA approved independent testing laboratory to perform tests and prepare test reports in accordance with 2019 CBC 2212A and 1704A. The IOR shall be responsible for monitoring the work of the special inspector and testing laboratories to ensure that the testing program is satisfactorily completed.

C. The independent testing laboratory shall conduct and interpret test and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

D. Provide access to all places where structural steel Work is being fabricated or produced so required inspection and testing can be performed.

E. The independent testing laboratory may inspect and/or test structural steel at plant before shipment; however, Architect reserves the right at any time before Final Completion to deem materials not in compliance with the specified requirements as defective Work.

F. Correct defects in structural Work when inspections and laboratory test reports indicate noncompliance with specified requirements. Perform additional tests as may be required to reconfirm noncompliance of original Work, and as may be required to show demonstrate compliance of corrected Work.

G. Welding: Inspect and test during fabrication and erection of structural steel assemblies as follows:

1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the Work. Record Work required and performed to correct deficiencies.
2. Inspect welds. Welds shall be visually inspected before performing any non-destructive testing. Groove weld shall be inspected by ultrasonic or other approved non-destructive test methods. Testing shall be performed to AWS D1.1 Table 6.3 cyclically loaded non-tubular connections.
3. Ultrasonic testing shall be performed by a specially trained and qualified technician who shall operate the equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Repair and test defective welds.
4. Rate of Testing: Complete joint penetration welds contained in joints and splices shall be tested 100 percent either by ultrasonic testing or by radiography.
5. Welds, when installed in column splices, shall be tested by either ultrasonic testing or radiography.
6. Base metal thicker than 1-1/2 inches, when subjected to through-thickness weld shrinkage strains, shall be ultrasonically inspected by shear wave methods for discontinuities directly behind such welds. Tests shall be performed at least 48 hours after completed joint has cooled down to ambient air temperature.
7. Any material discontinuities shall be reviewed based on the defect rating in accordance with the criteria of AWS D1.1 table 6.3 by the Architect and DSA.
8. Other method of non-destructive testing and inspection, for example, liquid dye penetrate testing, magnetic particle inspection or radiographic inspection may be performed on weld if required.
9. Lamellar Tearing: Lamellar-tearing resulting from welding is a crack (with zero tolerance) and shall be repaired in accordance with AWS D1.1.
10. Lamination: The rejection criteria shall be based on ASTM A 435.
11. Where testing reveals lamination or conditions of lamellar tearing in base metal, the steel fabricator shall submit a proposed method of repair for review by the Architect. Test repaired areas as required.
12. Magnetic Particle Testing: Magnetic particle testing when required shall be provided in accordance with AWS D1.1 for procedure and technique. The standards of acceptance shall be in accordance with AWS D1.1 – Qualification.

H. Lamellar Tearing: Prior to welding plates 1 to 1-1/2 inches thick and greater and rolled shapes within the distance from 6 inches above the top of the joint to 6 inches below the bottom of the joint shall be checked by ultrasonic testing for laminations in base metal which may interfere with the inspection of the completed joint. Should these defects occur, members will be reviewed by the Architect and DSA.

Welding procedure specifications in sub-section 1.5G specify welding practices to minimize lamellar tearing.

I. Prior Testing of Base Material: Test material before fabrication.

J. Lines and levels of erected steel shall be certified by a State of California licensed surveyor as set forth in related Division 01 section.

K. Welded studs shall be tested and inspected by the special inspector in accordance with requirements of AWS D1.1 – Stud Welding.

L. Record Drawings: After steel has been erected, correct or revise Shop Drawings and erection diagrams to correspond with reviewed changes performed in the field.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify governing dimensions and conditions of the Work before commencing erection Work.

B. Provide temporary shoring and bracing, and other support during performance of the Work. Remove after steel is in place and connected, and after cast-in-place concrete has reached its design strength.

3.2 ERECTION

A. Employ qualified riggers and plan erection to require minimum cutting. Erect members plumb, true to line and level, and in precise positions. Provide temporary bracing and guying to resist loads and stresses to which the structure may be subjected, including those due to erection equipment and its operation.

B. Anchor Bolts: Furnish and deliver anchor bolts with setting drawings and templates. Verify position of bolts prior to delivery of steel; report errors or deviation for correction.

C. Clean surfaces of base plates and bearing plates.

1. Install base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims; cut off flush with edge of base or bearing plate before packing with grout.

D. Maintain erection tolerances of structural steel within AISC Code of Standard Practice for Steel Buildings and Bridges.

E. Align and adjust steel members. Adjust for variations in elevation or alignment. Level and plumb structural members.

F. Do not permit thermal cutting during erection of structural steel.

G. Connections: Hold steel in correct position during welding and bolting, and provide for dead loads, wind, and all erection stresses. Do no welding or final bolting until members have been aligned and plumbed.

1. Field Welding: Conform to requirements for shop fabrication.
2. Common Bolts: Tighten and upset bolt threads to preclude loosening, or use approved self-locking nuts.
3. High-Strength Bolting: Tighten by turn of the nut method or with calibrated torque wrenches as specified for the shop high-strength bolting and according to Code, AISC Standards and the Reference Standard.

H. Where indicated for field connections, provide standard bolts complying with ASTM A325.

I. Install high strength steel bolts at locations indicated. Assembly and installation shall be in accordance with 2019 CBC requirements.

J. Erect structural steel plumb and level and to proper tolerances as set forth in the AISC Manual. Provide temporary bracing, supports or connections required for complete safety of structure until final permanent connections are installed.

K. Steel Columns: Set column bases in exact position for alignment, plumb and straight, supported on adjustable bolt supports or shims until grout has set. Set center of base true to column center within 1/16" and adjust column height exactly. Maintain bases at exact position and level during grouting. Fill grout space solid with non-shrink grout.

L. Damaged Members: During erection, straighten or replace members which are bent, twisted, or damaged as directed. If heating is required, perform heating by methods that ensure a uniform temperature throughout the entire member. When directed, remove members damaged to an extent impairing appearance, strength, or serviceability and replace with new members at no extra cost to the Owner.

M. Exposed Structural Steel members and components, plumbed, leveled and aligned to a tolerance not to exceed the amount permitted for structural steel.

3.3 FINISHING

A. After erection, spots or surfaces where paint has been removed, damaged, or burned off and field rivets, bolts, and other field connections not concealed in the Work, shall be cleaned of dirt, oil, grease, and burned paint and furnished with a spot coat of the same primer installed during shop priming.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Install paint to exposed areas with the same material installed during shop painting. Install by brush or spray to provide a minimum dry film thickness of 1.5 mils.

C. Painting: All steel members exposed to view in the final condition to building users other than maintenance staff shall be finished per 09 9600 High Performance Coatings.

3.4 FIELD QUALITY CONTROL

A. Owner will provide a special inspector and independent testing laboratory to perform field inspections and tests and to prepare test reports.

B. All welders shall be qualified for each process and position per the latest edition of AWS D1.1, Chapter 4, Part C - Performance Qualifications. The welder's qualification shall be considered as remaining in effect indefinitely unless the welder is not engaged in a given process of welding for which the welder is qualified for a period exceeding six months or unless there is some specific reason to question a welder's ability.

C. Inspection of Shop and Field Welding: Required for all structural steel according to 2019 CBC Section 1704A.3.1.4.

D. Inspection of High Strength Bolt Installation: Required for both shop and field installation according to 2019 CBC Section 1704A.3.3 and 2212A.2.

E. Erection Inspection: Inspector shall inspect all erection including the grouting under base plates.

F. Non-Destructive Welding Inspection: The Special Inspector(s) shall continuously inspect and test all welds by ultrasonic or other non-destructive tests as approved. Test procedure for ultrasonic tests shall conform to AWS D1.1 and requirements herein.

1. Required Testing: Test following welds by ultrasonic testing method:
    a. Full Penetration Groove welded connections of column to column, column to girder, girder to girder, and like connections.
    b. Other welded connections indicated to be ultrasonically tested on Structural Drawings.
    c. Other welds directed to be ultrasonically tested by the Architect, Structural Engineer, or Inspector Of Record.

2. Ultrasonic Testing: An AWS Certified Welding Inspector, approved by DSA shall operate ultrasonic testing equipment, examine welds, and maintain a record of welds examined, defects found, and disposition of each defect. Defective welds shall be repaired in accordance with AWS D1.1, latest revision, and costs for retesting defective welds shall be responsibility of the Contractor. Tests shall be complete tests according to AWS D1.1, latest revision.
3. Rate of Testing: Test welds requiring ultrasonic testing at 100 percent. No reduction in testing rate will be permitted.
4. Backing Strips: Remove backing strips whenever ultrasonic indications arising from weld roots can be interpreted as either a weld defect or a backing strip, and retest weld if no root defect is visible. If no defect is disclosed by retest and no significant amount of the base and weld metal is removed, joint needs no further repair or welding. Repair all defects disclosed. Contractor shall bear the cost of removals and repairs.
5. Ultrasonic Instrumentation: Calibrated by technician to evaluate the quality of welds in accordance with AWS D1.1, Sections 5 and 6.
6. Acceptance Criteria: In accordance with larger reflector criteria of AWS D1.1, latest revision.

G. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

3.5 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.6 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 05 30 00

METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal decking.
2. Shear connectors.

B. Related Requirements:

1. Division 01 - General Requirements.
2. Section 01 4200 - Testing and Inspection.
3. Section 05 1200 - Structural Steel Framing.
4. Section 07 6000 - Flashing and Sheet Metal.
5. Section 09 9100 - Painting and Coating

1.2 REFERENCES

A. ASTM A108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

B. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

D. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.

E. AWS D1.3 – Structural Welding Code Sheet Steel.

F. AISI – Specifications for the Design of Cold-Formed Steel Structural Members.

1.3 PERFORMANCE REQUIREMENTS

A. Compute properties of deck sections on basis of effective design width as limited by provisions of the AISI specifications. Provide no less than deck section properties specified, including section modulus and moment of inertia per foot of width.

B. Regulatory Requirements:

1. Requirements of Regulatory Agencies: DSA and Underwriters Laboratories Inc. (UL) approval for the decking when installed as a part of an assembly indicated on Drawings in which fire resistive construction ratings are required.
2. Work of this section shall be in accordance with CBC.

C. Manufacturers shall be members of Steel Deck Institute (SDI).

1.4 SUBMITTALS

A. Shop Drawings: Drawings, sections and details indicate type of decking, location, finish, gage of metal, arrangement of sheets, necessary fabrication to incorporate decking into the Work, and relationship to openings and flashing.

1.5 QUALITY ASSURANCE

A. General: Metal decking steel shall conform to requirements of strengths and properties of standards specified.

B. Qualifications of Welders: Properly certified for the type of Work involved in compliance with CBC requirements.

C. Continuous inspection of welding will be performed by a special inspector, approved by DSA to inspect the Work of this section. Refer to Section 01 4200 - Testing and Inspection. The Project Inspector shall be responsible for monitoring the work of the special inspector to ensure that the inspection program is satisfactorily completed.

D. Identification of metal decking steel shall conform to the standards specified in Section 01 4200 - Testing and Inspection.

1. Fabricator shall furnish sufficient evidence to the Architect attesting compliance with specified requirements.
2. Conform to CBC requirements. Unclassified or unidentified decking is not permitted. Furnish deck manufacturer's certified mill analyses and test reports for each heat covering decking having a minimum Fy of 33 Ksi. In addition, for decking having Fy greater than 33 Ksi, testing laboratory shall perform one tension and elongation test and one bend or flattening test for each gage.

E. Unidentifiable Steel: Steel which is not readily identifiable as to grade from markings and test records is not permitted to be provided as part of the Work of this section.

F. Payment For Tests and Inspections:

1. Owner shall pay inspection and testing costs of identifiable steel.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ASC Steel Deck.

B. Verco Manufacturing Co.

C. Epic Metals Corporation.

D. Equal with current ICC or IAPMO test report. All properties must be equal or better.

2.2 MATERIALS

A. Metal Decking: Roll-formed sheets conforming to ASTM A653, with G60 zinc coating.

1. Section properties shall conform to applicable provisions of latest edition of AISI - Specification for the Design of Cold-Formed Steel Structural Members.
2. Acoustical Cellular metal decking and perforated sheet at Classroom/Food Services Building to be galvanized. Refer to Section 09 9100 for deck surface preparation and paint.

B. Flexible Closure Strips for Deck: Vulcanized, closed-cell, expanded chloroprene elastomer, complying with ASTM D1056, Grade SCE #41.

1. Brittleness Temperature: Minus 40 degrees F, ASTM D746.
2. Flammability Resistance: Self-extinguishing,

C. Metal Flashing: 22 gage minimum, with ASTM A653, G60 zinc coating.

D. Metal Closures: 18 gage minimum, with ASTM A653, G60 zinc coating.

E. Shear Connectors: Headed stud type, ASTM A108 Grade 1015, cold-finished carbon steel complying with AISC specifications.

2.3 FABRICATION

A. Corrugated sheets or sections shall be designed to support required live load between supporting members.

B. Provide decking in lengths to span over three or more supports.

C. Except as detailed otherwise, provide decking with interlocking side laps, 2 ½-inch minimum end bearing, and 1 ½-inch minimum side bearing.

D. Welding: Provide materials and methods in accordance with recommendations of steel decking manufacturer and reviewed submittals. Hold decking tight to the supporting elements with screws or other means for proper welding or crimping of the decking edges. Conform to AWS D1.3, and to the patterns and weld types indicated, with welds free from sharp edges and protrusions. Field coat welds and abraded surfaces at completion with an anodic type galvanizing repair paint. Omit the field paint coating where welds or abrasions are covered by concrete fill or sprayed fireproofing.

PART 3 - EXECUTION

3.1 OPENINGS

A. Cut and reinforce units to provide openings which are located and dimensioned on the structural and mechanical Drawings.

B. Provide openings, or other Work not indicated on the Drawings.

3.2 INSTALLATION

A. Install metal decking in accordance with decking manufacturers' recommendations, requirements of Drawings, Shop Drawings, and Specifications.

B. Install metal decking on supporting steel framework and adjust to final position before permanently fastening in place.

1. Install each unit to proper bearing on supports.
2. Install units in straight alignment for entire length of run of cells with close registration of cells of one unit with those of abutting unit.

C. Fasten decking to steel framework at ends of units and at intermediate supports. Welding shall be as indicated on Drawings.

D. Fasten side laps between supports as indicated on Drawings.

E. Perform field cutting parallel with cells in area between cells, leaving sufficient horizontal material to permit welding to support steel.

F. Weld shear connectors to supports thru decking units as required by Drawings. Weld only on clean, dry surfaces. Do not weld shear connectors thru two layers of decking units.

G. Refer to Section 09 9100 for surface preparation and painting of acoustical cellular decking.

3.3 METAL FLASHINGS AND CLOSURES

A. Furnish, install, and weld in position, sheet metal closure flashing, closure angles, closure plates, profile plates, and shear plates.

B. Close open ends of cell runs at columns, openings, walls, similar interruptions and termination.

3.4 FIELD QUALITY CONTROL

A. Inspection: Install steel decking under continuous inspection according to CBC Chapter 1705A.2.

1. Welding inspection for steel deck diaphragms shall conform to CBC Section 2204A.1.

3.5 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.6 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 05 41 00

STRUCTURAL METAL STUD FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Load-bearing metal stud systems.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 01 42 00 - Testing and Inspection.

3. Section 05 12 00 - Structural Steel Framing.

4. Section 09 22 16 - Non-Structural Metal Framing.

1.02 SUBMITTALS

A. Shop Drawings: Submit drawings showing framing, connection details, accessories and anchorage. Indicate location of assemblies, size and spacing of framing components.

B. Product Data: Submit manufacturer's catalog data for each item proposed for installation.

C. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

1.03 QUALITY ASSURANCE

A. Comply with following as a minimum requirement:

1. AISI - Specifications for Design of Cold Formed Steel Structural Members.

2. Welds shall be performed by AWS certified welders. Welding shall be performed in accordance with requirements of American Welding Society (AWS) Structural Welding Code-Steel D1.1 and D1.3. Structural welding Code-Sheet Steel.

3. Welding shall be inspected by a special inspector, approved by DSA to inspect Work of this section. The Project Inspector shall be responsible for monitoring work of special inspector to ensure that inspection program is satisfactorily completed.

4. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by Hot Dip Process.

5. ASTM A924 – Standard Specification for General Requirements for Steel Sheet Metallic-Coated by Hot-Dip Process.

6. ASTM A1003 – Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

7. ASTM A1008 – Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.

8. ASTM C954 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks) and Bracing or Bridging for Screw Application of Gypsum Panel Products and Plaster Bases.

9. ASTM C955 – Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

10. ASTM C1007 – Standard Specification for Installation of Structural (Axial and Transverse) Steel Framing Members and Accessories.

11. ASTM E488 – Standard Test Methods of Strength Anchors in Concrete and Masonry.

12. ASTM E1190 – Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.

13. Manufacturer shall be a member of the Steel Stud Manufacturers Association (SSMA).

B. Tolerances: Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting a 10-foot straight edge for its entire length at any location within a 1/8 inch tolerance. Install horizontal framing level within a tolerance of 1/8 inch in 12 feet in any direction.

1.04 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered in their original unopened packages and stored protected from damage. Do not store material directly on grade. Provide adequate support to prevent bowing of material prior to installation.

B. Store welding electrodes in accordance with AWS D12.1.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide studs, tracks, joists, header, and accessories manufactured by one of following:

1. ClarkWestern Building Systems.

2. Dietrich Industries, Inc.

3. Marino/WARE.

4 Cemco.

5. Equal.

B. Special Connection Accessories: Products manufactured by The Steel Network, Inc., or equal.

2.02 MATERIALS

A. Light Gage Metal Framing:

1. Metal framing shall be formed from corrosion resistant-steel conforming to requirements of ASTM A653, 50 ksi minimum.

2. Metal framing shall be zinc coated in conformance to requirements of ASTM A926, G60.

3. Metal framing shall be manufactured in conformance to ASTM C955.

4. Install metal framing per ASTM C1007, Standard Specification for Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories.

B. Gages and properties of studs shall be as indicated on Drawings.

C. Mechanical anchors to concrete and masonry shall be metal cinch at least 3/8 inch in diameter threaded bolt head type. Anchor bolts to be installed in concrete shall be hook type ½ inch diameter or more. Unless otherwise indicated.

D. Mechanical anchors to metal framing shall be No. 10 self-tapping and self-drilling wafer-head screws.

E. Accessories: Special top tracks, angles, fasteners, and strips of gypsum wallboard, as required for fire rating assembly required at each condition.

F. Mineral Wool Safing Insulation: 4.0 pcf density. Thermafiber, Fibrex, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumb and true. Install necessary accessories for proper installation.

B. Anchor top and bottom runner track to ceiling or roof structure overhead and to floor structure below.

C. Install studs squarely in top and bottom runner track with firm abutment against track webs.

D. Align and plumb studs, and fasten to flanges of both top and bottom runner tracks.

E. Provide three studs minimum at corners of stud walls. Locate so as to provide surfaces for attachment of interior and exterior facing materials.

F. Members not indicated to be welded together shall be attached with manufacturer recommended screws with minimum one screw at each flange of stud to top and bottom track. Wire tying of framing members is not permitted.

G. Provide lateral bracing and bridging in accordance with manufacturer's written recommendations or as required by CBC.

H. Intersecting walls and partitions, whether load-bearing or not, shall be connected.

I. Splices in axially loaded studs are not permitted.

J. Splice or butt weld butt joints in runner tracks. No splices are permitted in tracks over lintels, diaphragm sheathing, or diagonal bracing.

K. Weld connections by fillet welds or plug welds in accordance with AWS recommended procedures and practices.

L. Touch-up field abrasions and welds with galvanizing touch-up material.

M. Studs that frame door openings shall be clipped to floor with 14 gage angle clips. Each clip to have two fasteners into studs and two fasteners into floor.

N. Provide additional joists or blocking adjacent to exterior and interior walls, openings and elsewhere as required to provide support for indicated ceiling construction.

O. Provide an additional joist under parallel partitions where partition length exceeds ½ joist span and around floor and roof openings which interrupt one or more spanning members.

3.02 CONNECTIONS TO METAL DECKING

A. Provide premolded neoprene filler strips matching flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.

B. Top runner track of fire-rated partitions shall be a minimum of 36 mils (20 gage), unless noted otherwise, and attached to metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Areas above runner shall be friction fit with a minimum depth of 2 ½ inches of 4 pounds per cubic foot density mineral wool insulation. A minimum of ½ inch of firestopping compound shall be installed to each side of mineral wool insulation for a one-hour system, and one inch of firestopping for a two-hour system. Install required special tracks, angles, fasteners and strips of gypsum wallboard to provide required fire resistance rating.

C. Fire-rated top tracks shall be installed in accordance with manufacturer's recommendations and fire rating approval requirements.

3.03 QUALITY CONTROL

A. Welding Inspection:

1. Inspection of field welding operations shall be performed by special inspector.

2. The special inspector shall inspect material, equipment, procedures, welds, and welder qualifications.

3.04 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.05 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

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SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Metal fabrications as indicated or required, including items such as the following:

1. Steel pipe.

2. Square and rectangular steel tubing.

3. Pipe columns.

4. Steel Door Frames.

5. Steel Frame Supports for overhead Doors.

6. Gratings, frames and covers.

7. Miscellaneous fabrications, as indicated on the Drawings.

C. Related Sections:

1. Section 01 42 00: Testing and Inspection.

2. Section 05 12 00: Structural Steel.

3. Section 08 71 00: Door Hardware.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating provided materials, dimensions, anchoring detail, and details of termination or connection to adjacent construction. Indicate items that are purchased from a manufacturer and items that are shop fabricated. Indicate component parts requiring Project site fabrication or assembly.

B. Product Data: Submit Product Data for manufactured items. Submit Product Data for primers and finishes.

C. Material Samples: Submit Samples of primers and finishes on fabricated items.

D. Installation Instructions: Submit installation instructions for manufactured items.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. Design, fabricate, and install miscellaneous metals in accordance with AISC - Design, Fabrication, and Erection of Structural Steel for Buildings.

2. AWS D-1.1 Code - Welding in Building Construction.

3. Inspection of Welding: Refer to Section 01 42 00: Testing and Inspection.

4. Welding: Refer to Section 01 42 00: Testing and Inspection.

B. Coordinate installation of accessory items required for metal fabrications.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store miscellaneous metal items above grade on platforms, skids, or other required supports.

B. Protect from corrosion or damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel Shapes: ASTM A 36.

B. Steel Pipe:

1. Steel pipe for pipe columns, and other structural purposes shall conform to ASTM A 53, Type E or S, Grade B, as required.

2. Steel pipe other than pipe furnished for structural purposes shall conform to ASTM A 53.

C. Square and Rectangular Steel Tubing:

1. Steel tubing for structural purposes shall be carbon steel conforming to ASTM A 500 or ASTM A 36.

2. Steel tubing other than tubing furnished for structural purposes shall be hot or cold rolled carbon steel electric welded tubing.

D. Cast Steel: ASTM A 27, Grade 65-35.

E. Steel Bolts: ASTM A 307, Grade A, with bolt head and nut dimensions conforming to ANSI B 18.2.1.

F. Rolled Steel Plates and Shapes:

1. Shapes and plates shall conform to ASTM A 36, except for plates to be bent or cold-formed.

2. Plates to be bent or cold-formed shall conform to ASTM A 283, Grade C.

G. Chain: Chain shall be 4/0 double loop pattern coil chain.

H. Grout: Non-shrinking type; Por-Rok, or equal.

2.02 FABRICATION

A. General:

1. For fabrication of Work exposed to view, provide only materials smooth and free of blemishes. Remove blemishes by grinding or by welding and grinding, before cleaning, treating, and installation of surface finishes including zinc coatings.

2. Form exposed Work true to line and level with accurate angles, surfaces, and straight sharp edges.

3. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated or specified.

4. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise damaging Work.

5. Form exposed connections with hairline joints, flush and smooth. Provide concealed fasteners wherever possible.

6. Remove loose rust, mill scale, cutting, and punching burrs.

7. Fabricate items in as large sections as practical to minimize assembly at the Project site.

B. Wire Guards, Partitions and Screens: Fabricate frames of hot-rolled steel channels of size indicated, with mortised and tenoned and riveted or welded joints. Fit frames with steel wire fabric with wires of fabric extended through channel frame and clinched. Fabric shall be 1-1/2 inch diamond mesh, 10 gage, except that at towel cages and window guards mesh shall be 1-1/4 inch diamond mesh, 9 gage. Wire guards in shops shall be installed in galvanized pipe frames as indicated.

1. Hinged panels and doors, where indicated, shall be fitted with galvanized steel butts, welded stops and padlock lugs. Towel cage shall receive hardware as indicated on Drawings or specified in Section 08710: Door Hardware. Frames, fabric, bolts, pipe supports, and other parts and fittings shall be galvanized.

C. Ladder Extensions: Where vertical ladders are installed for access to roof hatches, provide the following:

1. Roof hatch ladders shall be provided with ladder extensions where required by CBC. Ladder extensions shall be Bilco Model 1, "LadderUP Safety Post," or equal, on fixed ladders below roof hatches where indicated. Device shall be manufactured of high strength steel with telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Finish shall be black enamel. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer's instructions.

D. Structural-steel door frames:

Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

Galvanize and prime exterior steel frames.

Prime exterior steel frames with primer specified in Section 099100 "Painting and Coating".

E. Miscellaneous Framing and Supports:

1. Fabricate miscellaneous units to sizes, shapes and profiles indicated or, if not indicated, of necessary dimensions to receive adjacent Work retained by framing.

2. Except as otherwise indicated, space anchors 2 feet on center, and provide minimum anchor units of 1-1/4 inch x 1/4 inch x 8 inch steel straps.

3. Shelf angles for exterior construction shall be galvanized steel of sizes indicated.

F. Welding:

1. Weld connections unless otherwise indicated.

2. Weld corners and seams continuously and in accordance with requirements of AWS Code. Welds shall be inspected as required in Section 05120: Structural Steel.

3. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.

H. Galvanizing:

1. ASTM A 123, ASTM A 153, or ASTM A 386, as applicable, hot dip with 2.0 ounces per square foot on actual surface and 1.8 ounces per square foot minimum on any specimen, and as specified herein.

2. Galvanizing Repair Material: All States Galvanizing Powder, Drygalv by American Solder and Flux, or equal. Hot applied repair material, or anodic zinc- rich galvanizing repair paint conforming to Mil Spec DOD-P-21035.

3. Items to be galvanized shall be hot-dip galvanized in sections as large as possible.

I. Shop Finish:

1. Metal fabrications shall be provided with a coat of primer, except those indicated to be completed with exposed galvanized finish.

2. Primer: Lead-free red metal primer complying with Fed Spec TT-P-86G, Type I, II, or III; zinc molybdate complying with Fed Spec TT-P-645A. Minimum dry film thickness of primer shall be 2.0 mils.

3. Preparation for Primer Painting: Miscellaneous ferrous metal, except items specified galvanized, shall be thoroughly cleaned and prepared for painting, including removal of shipping oils or protective coatings, mill scale, grease, dirt and rust. Prepare in accordance with SSPC recommendations. Deliver to Project site primed or galvanized as indicated, and ready to receive Project site applied finishes.

4. Galvanized Metal Work to receive Paint: Clean oil, grease and other foreign materials from surfaces. Apply vinyl wash pretreatment coating. Follow manufacturer's instructions for drying time, and then prime with one coat of metal primer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Steel Thresholds: Fabricate channel or angle thresholds of rolled steel sections of size indicated, galvanized after fabrication. Anchor into concrete with countersunk 2-unit cinch anchor bolts, unless otherwise indicated.

B. Steel Ladders: Provide at locations indicated, fabricated as detailed. Ladders shall be anchored to concrete or masonry with 1/2 inch cinch anchor bolts. Ladders secured to a wood framed wall shall be anchored with 1/2 inch lag screws. Provide provisions for anchoring ladders before lath is applied to plastered walls.

C. Gratings, Frames and Covers:

1. Over areas indicated, provide steel gratings and grating frames as detailed. Frames shall have mitered and welded corners and be fitted with anchors.

2. Provide steel checkered plate covers and steel frames for sumps, grease traps, and sand traps, and other covers for access where indicated. Frames shall be provided with mitered and welded corners and be fitted with anchors as detailed. Cover shall be

perforated. Each section of access cover shall be furnished with steel pull rings and tool operated fastening device. Screws to fasten covers shall be brass.

3.02 ADJUSTING

A. Touch Up Damaged Surfaces:

1. Shop Painted Finishes: Comply with SSPC-PA-1 for touch-up; apply with brush to produce a minimum 2.0 mil dry film thickness.

2 Galvanized Surfaces: Clean field welds, connections and damaged areas. Repair galvanized finishes in accord with ASTM A 780.

3.03 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 05 53 13

BAR GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal bar gratings and metal frames and supports for gratings.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for structural-steel framing system components.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Clips and anchorage devices for gratings.
2. Paint products.

B. Shop Drawings: Include plans, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For gratings, including manufacturers' published load tables.

1.5 INFORMATIONAL SUBMITTALS

A. Mill Certificates: Signed by manufacturers of stainless steel certifying that products furnished comply with requirements.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
4. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. McNichols Model GW-150 (19W-4) 24” x 240”, 3/16” x 1 ½” bars, 1” space.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design gratings.

B. Structural Performance: Gratings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft.
2. .

C. Seismic Performance: Gratings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Component Importance Factor: 1.5.

2.3 METAL BAR GRATINGS

A. Metal Bar Grating Standards: Comply with NAAMM MBG 531, "Metal Bar Grating Manual."

B. Welded Steel Grating MBG-1:

1. Bearing Bar Spacing: 1” o.c.
2. Bearing Bar Depth: 1-1/2 inches.

3. Bearing Bar Thickness: 3/16 inch.
4. Crossbar Spacing: 4 inches o.c.
5. Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch bearing bars at **1 inches** o.c., and crossbars at 4 inches o.c.
6. Steel Finish: Shop primed.

2.4 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Bars for Bar Gratings: ASTM A36/A36M or steel strip, ASTM A1011/A1011M or ASTM A1018/A1018M.

C. Wire Rod for Bar Grating Crossbars: ASTM A510.

D. Uncoated Steel Sheet: ASTM A1011/A1011M, structural steel, Grade 30

2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A with hex nuts, ASTM A563 and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F593 for bolts and ASTM F594 for nuts, Alloy Group 1.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy **Group 1** stainless-steel bolts, ASTM F593, and nuts, ASTM F594.

2.6 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting and Coating".

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop unless otherwise indicated.
2. Fabricate toeplates for attaching in the field.
3. Toeplate Height: 4 inches unless otherwise indicated.

G. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

H. Do not notch bearing bars at supports to maintain elevation.

2.8 GRATING FRAMES AND SUPPORTS

A. Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch thick by 8 inches long.

B. Galvanize steel frames and supports in the following locations:

1. Exterior.

2.9 STEEL FINISHES

A. Finish gratings, frames, and supports after assembly.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

C. Shop prime gratings, frames, and supports not indicated to be galvanized unless otherwise indicated.

1. Shop prime with primers specified in Section 099100 "Painting and Coating" unless indicated otherwise.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast".

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior

units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Attach toe plates to gratings by welding at locations indicated.

F. Field Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099100 "Painting and Coating."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 53 13

SECTION 06 40 00

ARCHITECTURAL WOODWORK

PART 1 – GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Architectural woodwork, casework, trim, hardware, countertops, and shelving as indicated on Drawings.

C. Related Sections:

1. Section 08 80 00: Glazing.

2. Section 09 91 00: Painting and Coating.

3. Section 10 11 10: Visual Display Surfaces.

1.02 SECTION DEFINITIONS

A. "Sustainably managed" is defined as "forests that are being managed through a professionally administered forestry management plan in which timber growth equals or exceeds harvesting rates in both quantity and quality, protecting rivers and streams from degradation, minimizing damage to the forest when harvesting and promoting biodiversity".

1.03 SYSTEM DESCRIPTION

A. Design Requirements: Provide wood products from certified sustainably harvested sources.

1.04 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings of casework indicating materials and hardware, details of construction, dimensions, methods of fastening and installation details. Shop Drawings shall bear a WI Certified Compliance Label indicating that Shop Drawings fully meet requirements of WI grade specified. Shop Drawings shall indicate grounds, backing, blocking, sleepers and other items required for installation of casework, which are to be provided and installed as part of the Work.

B. Certificates: Provide WI Certified Compliance Certificate certifying that materials, fabrication and installation will comply with the specified requirements.

C. Material Samples: Submit 2 inch x 3 inch plastic laminate color Samples of manufacturer's entire color range.

D. Closeout Submittals: Provide a WI Certified Compliance Certificate for Installation.

1.05 QUALITY ASSURANCE

A. Comply with WI Manual of Millwork, grades as specified herein.

B. Each elevation of casework shall bear WI Certified Compliance Label indicating that casework fully meets requirements of WI grade specified.

C. Each plastic laminate countertop shall bear WI Certified Compliance Label indicating tops fully meet requirements of WI grade specified.

D. Mock-ups: When required by the Architect, submit a full-scale base cabinet, countertop, and wall-hung cabinet, illustrating joinery and plastic laminate finish. Base cabinet shall incorporate a drawer, an adjustable shelf, and a door. Wall-hung cabinet shall incorporate 2 doors, one adjustable shelf and finished end, including required hardware.

1.06 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to the Project site in undamaged condition, stored in fully covered, well ventilated areas, and protected from extreme changes in humidity and temperature. Refer to WI Manual for recommended care and storage.

B. In event of damage immediately furnish necessary repairs or replacements.

1.07 PROJECT CONDITIONS

A. Store indoors, in ventilated areas with constant but minimum temperature of 60 degrees F. and maximum relative humidity of 25 percent to 55 percent. At least seven days before installation, maintain temperature of 70 degrees F. and relative humidity of 50 percent to 55 percent. Acclimate materials to the installation temperature and humidity for at least 72 hours prior to installation. Maintain conditions until Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Plastic Laminate Faced Cabinets:

1. Plastic laminate: High pressure plastic laminate conforming to NEMA standard LD-3; 0.050 inches at horizontal surfaces, 0.028 inches at exposed vertical surfaces and edge bands, and 0.042 inch minimum for post-formed countertops.

2. Particle Board Core Material: 45 lb. density, conforming to ANSI A208.1, Table 1, Grade 1-M-2.

3. Solid Lumber:

a. Solid lumber for exposed members, drawers, trays and special details shall be Clear birch or maple.

b. Unexposed solid lumber for concealed webs or structural members shall be of Clear Douglas fir.

4. Softwood Plywood: Rotary cut exterior type A-C grade softwood plywood complying with PS1.

5. Hardboard: Factory finished pressure sealed hardboard conforming to the requirements of PS 58. Oil tempered hardboard shall conform to CS 251.

6. Cabinet Liner: Semi-exposed surfaces shall be finished with 0.020 inch high-pressure laminate cabinet liner, conforming to NEMA Standard LD-3.

7. Edge Banding:

   a. T-type extruded tenite-butyrate 1/16 inch minimum thickness, with serrated leg 3/8 inch in length.

   b. 0.028 inch minimum thickness plastic laminate.

8. Glass Doors: 1/4 inch laminated safety glass.

9. Adhesive: Type II water-resistant, rigid type glue of formula conforming to PS 51.

10. Sealer: Thompson Water Seal 101 or Watco Oil.

11. The Owner will supply tote trays unless otherwise indicated.

12. Base: Cover toe spaces with typical wall base unless otherwise indicated.

B. Wood Casework:

1. Particle Board: 45 lb. density, conforming to ANSI A-208.1, table 1, Grade 1-M-2.

2. Solid Lumber:

   a. Concealed portions: Any species of sound, dry, solid stock.

   b. Semi-exposed portions: Custom Grade hardwood veneer of the same species as exposed material with a specific gravity in excess of 0.37.

   c. Exposed portions: Premium Grade well matched for color and grain, select white birch veneer.

3. Hardboard: Factory finished, pressure sealed hardboard conforming to requirements of PS 58.

4. Edge Banding: Same species of wood as adjacent to exposed surfaces.

C. Countertop:

   a. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304 stretcher-leveled standard of flatness. C.Bright, Cold-Rolled, Unpolished Finish: No. 2B. Plywood underlayment.

D. Hardware:

1. Drawer Slides for Custom Grade Cabinetry:

   a. Pencil drawers: Partial extension type: Accuride 2006.

   b. Drawers and box drawers, up to 24 inches wide: Accuride 3832A.

c. Lateral file drawers, up to 30 inches wide: Accuride 4034 overtravel or 4033 equal travel.

d. Lateral file drawers, more than 30 inches wide: Accuride 3640.

2. Drawer Slides for Premium Grade Cabinetry:

a. Pencil drawers: Full extension type: Accuride 2632.

b. Drawers and box drawers, up to 24 inches wide: Accuride 7432.

c. Lateral file drawers, up to 30 inches wide: Accuride 4034 overetravel or 4033 equal travel.

d. Lateral file drawers, more than 30 inches wide: Accuride 4437.

3. Flipper Door Slides for Premium and Custom Grade Cabinetry:

a. For vertically mounted retracting cabinet doors up to 75 lbs. and 72 inches tall: Accuride 1432 with hinge carrier strip.

4. Mutes: Rubber, approximately 1/4 inch diameter, colors to match adjacent finish.

5. Plastic Grommets: Doug Mockett, or equal; color as selected by Architect.

6. Adjustable Shelves with Clips: Adjustable shelf supports (EDP type, unless otherwise noted) set in 5 mm holes spaced 32 mm on center:

a. Hafele America, Co., No. 282.04.711.

b. Hafele America, Co., No. 282.24.13.

7. Cabinet Hinges: Concealed type, minimum 170 degree opening, self-closing:

a. Hafele America, Co., No. 326.05.

b. Julius Blum, Inc., No. B71650.

c. Mepla, No. MD61-253-Z00.

8. Cabinet Locks:

a. Door Locks: Pin tumbler type – National No. 3713 x 2475-172 strike or Olympus 100DR x 12-1 strike.

b. Locks for Sliding Doors: National No. C8142 x thimble strike or Olympus 300 SD x thimble strike.

c. Drawer Locks: National 68-3718 x 68-2480C brass strike or Olympus 200 DW x 12-1 strike.

d. Cabinet locks shall be flush with surface of door and protrude no greater than 3/16”.

9. Top-hung Hardware Assembly for Sliding Doors: Grant No. 6064.

10. Track for Sliding Doors: K & V 455 x or 455.55.

11. Pull Flush Ring at Drawers behind Doors: Safe No. 6116 or BBW 24.

12. Pulls: BBW No. 79P, Quality No. 179 x 180 or Trimco No. 553P. Pulls shall be U-shaped wire pulls or equally accessible pull hardware at all accessible casework per CBC Section 1125B.4

13. Catches: Magnetic type - Epco No. 592 or Lawrence No. SC1364-AL.

14. Four-way Tension Catch: Glynn-Johnson GJ21A.

15. Noiseless Catch: Hardware Specialties 11687-FW7.

16. Elbow Catch: Ives 2A.

17. Bolts: Surface type BBW No. 97-B6, Quality B6 or Trimco No. 4856-6.

18. Brackets and Shelf Strip for Glass Shelves: K & V No. 80 x 180 or Garcy 604 x 686.

19. Shelf Standards and Brackets: K & V No. 255 x 256 or line bored holes for pins as approved by WI standards Stanley No. 798 x 799, steel zinc plated.

20. Card Holders for Drawers: Corbin No. 1913-1/4H or Garcy No. 853.

21. Hanger Rods: 1-1/16 inches minimum diameter metal tubing, aluminum or stainless steel clad, KV660; heavy wall steel tubing KV770.

22. Hanger Rod Flanges: KV757, or flanges KV734, KV735; Ronther Reiss R44-55; or equal.

23. Hardware Finish: With exception of finish hardware items which have finishes specified, hardware shall be furnished with dull chrome US 26D or dull stainless steel US 32D finish.

24. TV Pullout Extension and Swivel: Accuride Model CB360-258TV, or equal.

25. Keying:

    a. Key locks inside one room alike. Furnish 3 keys for each lock keyed separately, and 2 keys for each lock in keyed alike groups. Master keys shall be tagged and delivered to the IOR. Locks and keys shall be stamped with coded set number / direct digit.

    b. Cabinet locks shall be master-keyed and keyed alike. Backside of cabinet lock bolts (on visible side following installation) and change keys shall be stamped with manufacturer's code, either direct digit or coded series. Change keys shall also be stamped with set numbers direct digit.

    c. Master keys shall be National GM2

2.02 FABRICATION

A. Plastic Laminated Casework: Construction of plastic laminated casework shall conform to the material and construction requirements for WI Custom grade flush overlay construction.

1. Exposed Vertical Panels and Doors: Exposed fixed panels and doors, including exposed ends of cabinets and both ends of each cabinet shall be 3 ply laminate construction consisting of plastic laminate with particle board and a balancing sheet, bonded together under pressure with adhesive. Total nominal thickness of panels and doors shall be 0.75 inch unless otherwise indicated.

2. Exposed bottom of wall-hung cabinets shall be furnished with plastic laminate finish.

3. Semi-exposed Panels: Interior panels, bottoms, and tops shall be 3/4 inch particleboard minimum. Bottoms of upper cabinets spanning 42 inches or more shall be one inch thick.

4. Webs: Stiles, rails and muntins of web frame shall be tongue and grooved at joints and glued. Top and bottom rails shall be continuous. Use of 8 mm wooden dowels, screws or biscuits shall be in accordance with WI Standards.

5. Cabinet bases may be integral or separate. Bases shall be 3/4 inch thick plywood securely jointed at 4 corners to a supporting block 1-1/2 inches thick.

6. Ends: Cabinet ends shall be minimum 3/4 inch thick, lock-jointed, doweled, glued, and screwed to webs or top and bottom of the cabinet.

7. Backs shall be 1/4 inch thick plywood or 1/4 inch thick particle board, and shall be plowed into sides and top (except countertops) glued and nailed on 4 inch centers. Back shall be braced with horizontal 3/4 inch x 3-1/2 inch backing strips on 3 feet centers maximum. Cabinets with exposed finish backs shall have 3/4 inch backs of laminate construction. Where exposed finished cabinet end and back form an external corner, plastic laminates shall meet at corner.

8. Adjustable shelving shall be 3/4 inch thickness particleboard for spans up to 25 inches and one inch thickness for spans over 25 inches up to 34 inches. Adjustable shelving over 34 inches in span shall be one inch thick plywood core with 0.020 inch cabinet liner both sides. Shelving hardware shall be adjustable to one inch centers. Faces and edges of shelving shall be finished with 0.020 inch thickness cabinet liner both sides.

9. Drawers:

    a. Sides, backs, and sub-fronts of drawers shall be of dovetail or dowel construction and made of 1/2 inch thick clear birch or maple solid stock. Drawer bottoms shall be in accordance with WI requirements, glue blocked and nailed.

    b. Drawers shall be fitted with ball bearing slides accurately installed for smooth drawer operation.

    c. Drawer fronts shall be of 3/4 inch thick plastic laminate construction, fully edge-banded with plastic laminate T-banding to be used when matching existing. T-banding joint shall occur at center of bottom edge of panel.

10. Doors:

    a. Doors shall be of overlay type with flush exposed surfaces. Doors shall be fully edge-banded with plastic laminate. Joint in banding shall occur at center

of bottom edge. Doors of cabinets within any group of adjacent units shall be in alignment.

b. Hinges shall be routed into edge of door. Doors over 40 inches in height shall have 3 hinges.

11. Back Priming: Seal unfinished materials installed for backs, bases, self-edge backing, stripping and other concealed portions with a water-repellent sealer.

12. Banding:

a. Exposed edges of interior and exterior laminates shall be edge banded with plastic laminate. Edge banding shall be provided in longest available lengths.

b. Edge banding shall be accurately fitted. Where edge band joins plastic surfaces, there shall be no open spaces, voids, or chipping of plastic laminate surface.

c. Exposed cabinet surfaces shall be flush, and any protruding edges of banding shall be machined or trimmed to provide a flat smooth corner at intersection of banding and adjoining surfaces. Plastic laminate edge banding shall be installed on tops, webs, bottoms, ends, and inside partitions. T banding may only be installed on drawer fronts and door edges and only as required to match existing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Work of this section as specified in the WI Manual of Millwork.

B. Cabinets: Install cabinets level, plumb, and secure to walls. Exposed screws shall have finish washers.

C. End Panels and Fillers: Furnish to match exposed surfaces and accurately scribe to walls and neatly and securely fit to cabinets.

D. Completion: Upon completion of installation, cabinets including drawers and shelves shall be cleaned. Doors and drawers shall operate easily and freely.

E. Scribe plastic laminated cabinets to walls. Installation of surface-applied moldings is not permitted.

3.02 CLEAN UP

A. Remove debris, rubbish and waste material and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 06 16 00

SHEATHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Exterior sheathing.

B. Related Sections include the following:

1. 05 4100 Structural Metal Stud Framing.

1.03 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.

3. For fire-retardant treatments specified to be High-Temperature (HT) type, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

6. For building wrap, include data on air-/moisture-infiltration protection based on testing according to referenced standards.

1.04 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

B. Forest Certification: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":

1. Plywood.

2. Oriented strand board.

3. Fiberboard wall sheathing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack plywood and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PANEL PRODUCTS, GENERAL

A. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.

B. Oriented Strand Board: DOC PS 2.

C. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

D. Factory mark panels to indicate compliance with applicable standard.

2.02 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA C9.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.03 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 24/0

2. Nominal Thickness: Not less than 1/2 inch.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1, Structural I sheathing.

1. Span Rating: Not less than 24/16.

2. Nominal Thickness: Not less than 15/32 inch.

2.04 ROOF SHEATHING (Sloped Mansard)

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.

1. Span Rating: Not less than 40/20

2. Nominal Thickness: Not less than 5/8 inch.

2.05 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For roof and soffit sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329 inch thick, attach sheathing to comply with ASTM C 1002.

2. For steel framing from 0.033 to 0.112 inch thick, attach sheathing to comply with ASTM C 954.

G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.06 MISCELLANEOUS MATERIALS

A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.

2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

3. Table 23-II-B-1, "Nailing Schedule," and Table 23-II-B-2, "Wood Structural Panel Roof Sheathing Nailing Schedule," in ICBO's "Uniform Building Code."

4. Table 2305.2, "Fastening Schedule," in BOCA's "BOCA National Building Code."

5. Table 2306.1, "Fastening Schedule," in SBCCI's "Standard Building Code."

6. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

7. Table 602.3(1), "Fastener Schedule for Structural Members," and Table 602.3(2), "Alternate Attachments," in ICC's "International One- and Two-Family Dwelling Code."

D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30S, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

a. Nail to wood framing.

b. Space panels 1/8 inch apart at edges and ends.

3.03 FIBERBOARD SHEATHING INSTALLATION

A. Comply with ASTM C 846 and with manufacturer's written instructions.

B. Fasten fiberboard sheathing panels to intermediate supports and then at edges and ends. Use galvanized roofing nails]; comply with manufacturer's recommended spacing and referenced fastening schedule. Drive fasteners flush with surface of sheathing and locate perimeter fasteners at least 3/8 inch from edges and ends.

C. Install sheathing vertically with long edges parallel to, and centered over, studs. Install solid wood blocking where end joints do not occur over framing. Allow 1/8-inch open space between edges and ends of adjacent units. Stagger horizontal joints if any.

D. Cover sheathing as soon as practical after installation to prevent deterioration from wetting.

END OF SECTION 06 16 00

SECTION 07 13 00

SHEET WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Sheet waterproofing in locations indicated including:

1. Sheet waterproofing on vertical walls below grade enclosing occupied spaces.

2. Sheet waterproofing in planters.

3. Drainage sheets and protection boards.

4. Strip waterproofing at sills, under roof edges, valleys, eaves, ridges and other flashings as indicated.

5. High-temperature resistant sheet underlayment on rigid insulation under metal roofing.

6. Monolithic Membrane Waterproofing (Fabric Reinforced) application for all substrates other than concrete.

C. Related Sections:

1. Section 01 42 00: Testing and Inspections.

2. Section 03 30 00: Cast-In-Place Concrete.

3. Section 04 22 00: Concrete Unit Masonry.

1.02 SUBMITTALS

A. Manufacturer's Qualifications: Provide a list of projects of similar design and complexity completed within the past 5 years.

B. Installer's Qualifications: Submit a certificate, prepared by the waterproofing system manufacturer, stating waterproofing applicator is certified by the waterproofing material manufacturer and, upon completion, submit a certificate stating that waterproofing systems have been installed in conformance with reviewed submittals and manufacturer's recommendations.

C. Product Data: Submit manufacturer's Product Data including installation instructions.

D. Shop Drawings: Submit Shop Drawings indicating each condition of the Work. Indicate all adjoining Work, and indicate methods of adhesion and attachment, laps, and related conditions.

E. Samples: Submit Samples, not less than 12 inches square, of each type of composite sheet membrane, mounted on plywood. Submit 12 inch square Samples of each type of drainage and protection board.

1.03 QUALITY ASSURANCE

A. References:

1. ASTM E 96 - Water Vapor Transmission of Materials; Method B.

2. ASTM E 154 - Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs.

B. Qualifications of Manufacturer: Sheet membrane waterproofing system shall be manufactured by a firm with a minimum of 20 years experience in the production of self-adhesive sheet membrane waterproofing.

C. Qualifications of Installer: A firm which has at least 3 years experience in work of the type required by this section and is recommended by manufacturer to install the specified products.

D. Pre-Installation Conference and Inspection: After review of submittals but before starting installation of the Work of this section, conduct a meeting at the Project site attended by the Project Inspector, Architect, OAR, Contractor waterproofing applicator and a technical representative of the waterproofing material manufacturer. The waterproofing applicator and material manufacturer's technical representative shall inspect the substrates to receive Work of this section and report defective conditions to Project Inspector, Architect, OAR and Contractor.

E. Manufacturer's Representative: Provide arrangements necessary to have a trained representative of the manufacturer visit the Project site on a weekly basis during membrane waterproofing Work to review installation procedures.

F. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened containers or packages with manufacturer's labels intact.

B. Store materials at the Project site under cover and maintain in dry condition. Protect from damage from excessive temperature and construction operations. Do not double-stack pallets of membrane. Protect mastic and adhesive from moisture and excessive heat. Store drainage composite or protection board flat and above grade. Provide cover on top and all sides of pallets and provide for adequate ventilation. Protect surface conditioner from freezing.

1.05 PROJECT CONDITIONS

A. Apply sheet waterproofing materials only in dry weather and when outside temperature is above 40 degrees F and below 90 degrees F

B. Do not apply sheet waterproofing materials to damp or wet surfaces unless specifically approved in writing by manufacturer.

1.06 WARRANTY

A. Manufacturer shall provide a 5 year material warranty.

B. Installer shall provide a 5 year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Sheet waterproofing shall be as manufactured by W.R. Grace & Co., W.R. Meadows, Inc., or equal.

B. Fabric Reinforced Monolithic Membrane shall be as manufactured by American Hydrotech, Inc., or equal.

2.02 MATERIALS

A. Sheet waterproofing material shall be self-adhesive, cold-applied such as W.R. Grace Bituthene 4000, W.R. Meadows Mel-Rol, or equal. The material shall be a self-adhesive, cold-applied composite sheet consisting of a thickness of 0.056 inches of rubberized asphalt and 0.004 inches of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet, which is removed during installation. No special adhesive or heat shall be required to form laps.

B. Surface conditioner: W.R Grace Bituthene 4000, W.R. Meadows Mel-Rol, or equal, latex based surface conditioner.

C. Adhesives fillets and sealers: Types as recommended by manufacturer for installation with specified membrane sheet.

D. Prefabricated Drainage Sheet:

1. For vertical surfaces: Hydroduct 2, Mel-Drain 5035B, or equal, consisting of a dimpled high impact polystyrene core and a needle punched non-woven filter fabric adhered to one side of the core. A film shall be adhered to the other side of the core.

2. For horizontal surfaces: Hydroduct HSF, Mel-Drain 7555, or equal, consisting of dimpled high impact polystyrene core and an extra heavy woven filter fabric bonded to the core.

E. Protection board for horizontal surfaces shall be 1/8 inch thick asphalt-impregnated hardboard; APOC, W.R. Meadows PC-2, or equal. Protection board for vertical surfaces shall be 1 inch thick expanded polystyrene.

F. Strip waterproofing sheet for all sills, doors/windows, wall parapets, under roof edges, valleys, eaves, ridges, and under copings and flashings:

1. High temperature resistant sheet underlayment: W.R. Grace "Ultra", GAF StormGuard HT Leak Barrier, or equal, self-adhesive roofing underlayment designed for use in high temperature applications, consisting of a thickness of 0.076 inches of butyl rubber based adhesive and 0.004 inches of cross-laminated, high density polyethylene and backed by a protective plastic release liner.

G. Fabric Reinforced Monolithic Membrane 6125 system with two layers rubberized asphalt membrane with spunbound polyester fabric reinforcing sheet between.

PART 3 - EXECUTION

3.01 PRELIMINARY WORK

A. Inspect and verify condition of substrates and related Work, in the presence of the manufacturer’s technical representative. Do not start installation of membranes until defects in substrates have been corrected. Concrete shall be smooth, dry, and free of voids. Masonry shall have a parge coat applied. Wood decks shall be clean, dry, and free from projecting nails, splinters, and foreign materials.

3.02 APPLICATION OF MEMBRANE ON VERTICAL WALLS BELOW GRADE ENCLOSING OCCUPIED SPACES AND IN PLANTERS

A. Surface Conditioning: Install surface conditioner and allow to dry to surfaces to be covered with membrane the same day.

B. Corner Treatment: Pretreat inside corners with liquid membrane compound, to form a fillet or use formed reinforcement fillet recommended by manufacturer. Smooth all surfaces of outside corners.

C. Horizontal Surfaces: Install 9 inch wide strips of membrane material over construction joints, cracks, and grouted joints. Seal expansion joints as recommended by manufacturer. At drains and vertical projections, install two layers of membrane sheet extended out not less than 6 inches in all directions, and seal. At drains, extend the membrane into the clamping ring and seal. Over prepared surfaces install membrane in one layer and roll into place. Lap sheets 2-1/2 inches at edges and ends.

D. Vertical Surfaces: Install membrane vertically in heights to 8 feet. Lap seams 2-1/2 inches. Roll membrane with hand roller. Extend membrane over top of foundation walls, planter walls and parapet walls, except where reglets are provided for termination.

3.03 PREFABRICATED DRAINAGE SHEET

A. Vertical Surfaces: Install rolls of vertical drainage sheet over the completed membrane, starting at the base of the wall. Peel the fabric back approximately 12 inches from the lower edge. Where drainage pipe occurs, install the drain core behind the pipe and extend the fabric over the outside of the pipe. Adhere the drainage sheet to the wall using strips of adhesive as recommended by manufacturer.

B. Horizontal Surfaces: Adhere the drainage sheet to the membrane with strips of adhesive. Butt adjacent panels together and overlap fabric onto the previous panel. At corners, cut the core and cover the core with filter fabric or tape.

3.04 COMPOSITE STRIP WATERPROOFING

A. Provide at sills, copings, eaves, ridges, and under other flashing as indicated. Do not fold over exposed edges. Prime concrete and masonry surfaces as recommended by manufacturer. Cut the membrane into 10 to 15 foot lengths and reverse roll. Separate membrane from release paper, press firmly into place, and roll to eliminate bubbles and assure full adhesion. Lap sides of sheets not less than 3.5 inches and ends not less than 6 inches.

3.05 HIGH TEMPERATURE RESISTANT UNDERLAYMENT

A. Seal joints in insulation as recommended by manufacturer. Prime insulation at rate of one gallon per 500 square feet if recommended by manufacturer. Over prepared surfaces install membrane in one layer and roll into place. Lap sheets 3-1/2 inches at edges and 6 inches at ends. Roll firmly into place to obtain full adhesion of sheets to substrate.

3.06 APPLICATION OF MONOLITHIC MEMBRANE FOR ALL SUBSTRATES OTHER THAN CONCRETE

A. Membrane Application

1. Install the rubberized asphalt membrane at a rate to provide a continuous, monolithic coat of 90 mil (approximately 2.3 mm), into which is fully embedded a layer of spunbound polyester fabric reinforcing sheet, followed by another continuous monolithic coat of

membrane at a minimum thickness of 125 mil or approximately 3.2 mm. Total membrane thickness to be provided is 215 mils or approximately 5.5 mm.

2. Overlap fabric reinforcing sheet 1 to 2 inches (25.4 – 50.8 mm) with membrane between sheets.

3.07 PROTECTION BOARD

A. Cover all surfaces, vertical and horizontal, with protection board, unless indicated otherwise. Install with adhesive recommended by manufacturer, and compatible with membrane materials.

3.08 TESTS OF MEMBRANES

A. All horizontal membranes shall be subjected to standing water test after completion, but before protection board is applied. Tests shall be conducted as soon as possible after completion of membrane in each area. When membrane installation is completed, seal drain, sandbag perimeter, fill membrane with water to height of not less than 2 inches, pond test for not less than 24 hours, repair all leaks or defects disclosed, and test until results are satisfactory. Remove all sandbags, plugs and drain when testing is completed. Clean surfaces of membrane.

3.09 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 07 1400

FLUID APPLIED WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Elastomeric waterproofing on planter and retaining walls not part of building walls.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 33 4000 - Storm Drainage Utilities.

3. Section 03 3000 - Cast-in-Place Concrete.

4. Section 04 2200 - Concrete Unit Masonry.

1.02 SUBMITTALS

A. Certificates: Submit a certificate stating applicator is certified by the elastomeric waterproofing material manufacturer, and upon completion, submit a certificate stating that elastomeric waterproofing systems have been installed in conformance with reviewed submittals and manufacturer's recommendations.

B. Product Data: Submit manufacturer's Product Data including complete installation instructions.

C. Shop Drawings: Submit Shop Drawings indicating each condition of the Work. Indicate all adjoining Work, and indicate methods of adhesion, attachment, and related conditions.

D. Samples: Submit Samples of elastomeric membrane waterproofing on flat plywood board, not less than 12 inches square, illustrating color and texture.

E. Experience Record: Submit a list of at least five installations on which each of the materials and systems proposed for installation have been in satisfactory service for at least three years.

1.03 QUALITY ASSURANCE

A. References:

1. ASTM D6506, Standard Specification for Asphalt Based Protection for Below-Grade Waterproofing.

B. Qualifications of Manufacturer: Elastomeric waterproofing system shall be manufactured by a firm with a minimum of 20 years experience in the production of elastomeric waterproofing.

C. Qualifications of Installer: A firm which has at least three years experience in work of the type required by this section and is recommended by manufacturer to install the specified products.

D. Pre-Installation Conference and Inspection: After review of submittals but before starting installation of the Work of this section, conduct a meeting at the Project site attended by the Project Inspector, Architect, Owner's Representative, Contractor, waterproofing applicator, and a technical representative of the elastomeric waterproofing material manufacturer. The waterproofing applicator and material manufacturer's technical representative shall inspect the substrates to receive Work of this section and report defective conditions to Project Inspector, Architect, Owner's Representative and Contractor.

E. Manufacturer's Representative: Provide arrangements necessary to have a trained representative of the manufacturer visit the Project site on a weekly basis during elastomeric waterproofing Work to review installation procedures.

F. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds of not over 350 grams per liter.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class and grade. Each container shall be identified with material name, date of manufacturer and batch number.

B. Store materials at the Project site under cover and maintain in dry condition. Protect from damage from excessive temperature and construction operations. Do not double-stack containers. Protect mastic and adhesive from moisture and excessive heat.

C. Store drainage composite or protection board flat and above grade. Provide cover on top and all sides of pallets and provide for adequate ventilation. Protect surface conditioner from freezing.

1.05 PROJECT CONDITIONS

A. Install suitable impervious type masking to preclude staining of surfaces to remain exposed wherever elastomeric waterproofing abuts or laps on to other finish surfaces, and provide additional protection as necessary to supplement masking; cover entire area of building subject to damage or staining.

B. Protect adjacent Work during installation of Work of this Section.

C. Install Work of this section, only in dry weather and when outside temperature is within the limits established by the manufacturer of the materials and products used.

D. Do not install any materials when water in any form is present on the surface or if materials are wet.

1.06 WARRANTY

A. Manufacturer shall provide a three year material warranty.

B. Installer shall provide a three year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Elastomeric waterproofing shall be a two-component, unmodified polyurethane waterproofing: Comply with ASTM C836.

1. Pacific Polymers, Inc. Elasto-Deck B.T. 100 percent solids.

2. Gaco Western, Inc.LM-60.

3. Carlisle Coatings & Waterproofing Inc., CCW 703 Liquiseal.

4. Tremco Inc., Temproof 201.

5. Equal.

2.02 MATERIALS

A. Pacific Polymers, Inc., Elasto-Deck B.T. 100 percent solids System, as a standard of quality, conforming to the following:

1. Application:

a. 60 mils thick – smooth surfaces.

b. 90 mils thick – rough surfaces.

2. Material Types:

a. Type I: For horizontal surfaces.

b. Type II: For vertical surfaces.

c. Elasto-Deck B.T. Knifegrade: For cracks, voids and other surface irregularities.

2.03 RELATED MATERIALS

A. Sealants: Compatible with waterproofing materials as recommended by manufacturer.

B. Backer Rod: Closed-cell Polyethylene rod.

C. Flashing Tape: Woven glass cloth tape.

D. Protection Course: Minimum 1/8 inch thick complying with ASTM D6506, semirigid sheets of fiberglass or mineral-reinforced asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.

E. Cleaning Materials: Solvent recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Surfaces must be clean and free of any oil, dirt, grease, and other contaminants, which will interfere with adhesion of the coatings. Surfaces shall be left broom clean.

B. Concrete:

1. Concrete surfaces shall be trowel finished followed by a light brooming, left free of loose particles, ridges, projections, voids and droppings that would interfere with the application of the coatings.

2. Concrete surfaces shall be water cured in lieu of curing compounds for a minimum of 28 days. If curing compounds are furnished, they shall be compatible with the provided waterproofing system.

C. Substrate conditions and surfaces shall be subject to inspection by the manufacturer and installer. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect building from damage resulting from spillage, dripping and dropping of materials. Prevent materials from entering and clogging drains and waterways.

B. Concrete

1. Surfaces to receive elastomeric waterproofing system shall be cleaned by sandblasting or acid etching. If acid etching is provided, a 10 percent to 15 percent muriatic acid solution applied by mop or broom, shall be allowed to remain on the surface approximately 10 minutes or until bubbling ceases. Surfaces shall then be washed with clean water to remove residues and shall be allowed to dry.

C. Cracks and Control Joints

1. Except for non-moving shrinkage cracks, all other cracks and joints must be sealed with a single component sealant of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer’s recommendations.

2. Large cracks, 1/16 inch and over, shall be routed out as required by the manufacturer and sealed with an elastomeric sealant. Apply sealant to inside area of cracks only. Do not install on concrete deck surfaces.

3. Seal secondary control and expansion joints with sealant and backer rod as recommended in the installation specifications of the elastomeric membrane waterproofing.

3.03 INSTALLATION

A. Install Elastomeric membrane waterproofing in accordance with manufacturer's printed instructions except as hereinafter specified. Coordinate the Work so the complete membrane is installed in a continuous operation, and that all areas where installation has started, per coat, are completed the same working day.

B. Elastomeric Membrane Waterproofing - 60 mils thickness, Smooth Surface Installation:

1. Cracks 1/16 inch and over shall be routed or saw cut and filled with joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer’s recommendations.

2. At intersections of membrane and vertical walls, columns, pipes, and other penetrations, install a ¾ inch fillet bead at the meeting angle using a joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer’s recommendations.

3. Install the first coat of the elastomeric membrane waterproofing at a rate of 50 square feet per gallon by airless spray, roller, brush, or squeegee according to the manufacturers installation procedures for smooth surfaces.

4. After a 24 hour curing period, install a second coat of elastomeric membrane waterproofing at the same 50 square feet per gallon rate to provide a total dry film thickness of 60 mils.

C. Elastomeric Membrane Waterproofing -- 90 mils thickness, Rough Surface Installation:

1. Cracks 1/16 inch and over shall be routed or sawcut and filled with joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.

2. At intersections of membrane and vertical walls, columns, pipes and other penetrations, install a ¾ inch fillet bead at the meeting angle using a joint filler of the same manufacturer as the elastomeric membrane waterproofing and installed according to manufacturer's recommendations.

3. Install the first coat of elastomeric membrane waterproofing at a rate of 35 square feet per gallon by airless spray, roller, brush, or squeegee according to the manufacturers installation procedures for rough surfaces.

4. After a 24 hour curing period, install a second coat of elastomeric membrane waterproofing at the same 35 square feet per gallon rate to provide a total dry film thickness of 90 mils.

3.04 INSPECTION

A. The wet film thickness of each coat shall be checked during application by averaging numerous measurements taken with a film gage and thickness shall be sufficient that when cured the dry film thickness will be as specified herein.

B. Surfaces coated shall be visibly checked to insure areas have not been missed and all holidays in the film are repaired.

C. Coating Work shall be subject to inspection at any time to insure compliance with the manufacturer's recommendations. Test areas shall be cut whenever requested by the manufacturer's technical representative to verify conformance to the Specifications. Unsatisfactory area shall be remedied by the applicator.

3.05 PROTECTION COURSE

A. Install protection board on cured membrane after testing, without delay, so that the period of exposure shall be minimized.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.07 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Thermal batt insulation for exterior walls and under roof decks.

2. Thermal batt insulation in furring at concrete or masonry walls.

3. Acoustical batt insulation in partitions and above acoustical ceilings where indicated.

C. Related Sections:

1. Section 05 30 00: Metal Decking.

2. Section 05 41 00: Load-Bearing Metal Studs.

3. Section 09 22 16: Metal Support Assemblies.

1.02 SUBMITTALS

A. Product Data:

1. Material List: Provide a list of materials for installation under this section.

2. Provide manufacturer's printed Product Data for each type insulation and accessory.

B. Manufacturer's Instructions: Submit manufacturer's printed installation instructions.

C. Certification: Provide certification that insulation materials conform to requirements of CBC Section 719.

D. Recycled Content: Provide certification that insulation materials contain a minimum of 30 percent recycled materials.

1.03 QUALITY ASSURANCE

A. Surface Burning Characteristics: Flame spread rating shall not exceed 25 and smoke density shall not exceed 50 when tested in accordance with ASTM E 84.

B. Comply with following as a minimum requirement:

1. ASTM C 177 - Standard Test Method for Steady-State Heat Flux-Measurements and Thermal Transmission Properties by Means of the Guarded-Heat-Plate Apparatus.

2. ASTM C 518 - Standard Test Method for Steady-State Heat Flux-Measurements and Thermal Transmission Properties by Means of Heat-Flow-Meter Apparatus.

3. ASTM C 665 – Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

4. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

5. ASTM E 119 - Standard Test Method for Fire Tests of Building Construction and Materials.

6. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750º C.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site and store in a safe, dry place, with labels intact and legible at time of installation.

B. Protect building insulation materials from damage.

1.05 PROJECT CONDITIONS

A. Avoid exposure to humidity and moisture. Protect from exposure to sunlight.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Owens Corning.

B. Johns Manville.

C. CertainTeed Corporation.

2.02 MATERIALS

A. General:

1. Provide Unfaced, friction-fit batt insulation where both sides of installation are enclosed

2. Provide batt insulation with integral vapor barrier when one side of installation will be unenclosed.

3. Provide batt insulation with integral vapor barrier where at least one side of installation will be exposed to high humidity, such as showers.

4. Recycled content shall be a minimum of 30 percent.

B. Thermal Insulation:

1. R-value: R21

2. Unfaced Mineral Fiber Batt Insulation: Provide friction-fit, unfaced mineral fiber batts. Insulation shall consist of mineral fibers, glass or slag, and thermosetting resins complying with ASTM C 665, Type I.

3. Faced Mineral Fiber Batt Insulation: Provide mineral fiber batts with vapor barrier consisting of mineral fibers, glass or slag, and thermosetting resins complying with ASTM C 665, Type III, Class A, with vapor-retardant membrane facing.

C. Acoustic Insulation: Fiberglass batts, with or without facing, friction fit, incombustible, minimum 3-1/2" thickness unless otherwise indicated, nominal 0.65 to 2.50 pcf density.

D. Fasteners for Attaching Insulation to Underside of Metal Roof Decks:

1. Spindle Anchors: Stic-Klip Mfg. Co., Type A or B as required, with Type S adhesive; Miracle Adhesives Corp. "Miracle StukUps" with Type HT994 adhesive; or Goodloe E. Moore Gemco or Tuff-Weld with G-P Improved or Tuff-Bond Quik-Set Type Adhesive as applicable; or equal. Provide adhesives of correct type for substrates and type of anchor.

2. String Wires: Minimum 18 gage galvanized steel wire.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine Work to verify suitability to receive insulation. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:

1. Fit batt insulation snugly between framing members.

2. Maintain total insulation integrity over entire area to be insulated, including areas between closely spaced members.

3. Extend full thickness insulation over entire area to be insulated. Furnish manufacturer's recommended clips to tightly fit batts at joints.

4. Cut and fit batt insulation tightly around pipes, conduits and penetrations.

5. Do not compress batt insulation in excess of 10 percent (R-19 may be installed in 2x6 stud walls).

6. Prevent batt insulation from sagging during and after installation by installing adequate wire.

7. Metal door and window frames in acoustically insulated walls shall be filled with insulation, unless otherwise indicated.

8. Where vapor barrier is provided, install with vapor barrier facing room.

a. Batts In Metal Framing: Provide friction-fit batts tightly fitted to stud webs and to metal furring.

b. Batts Under Metal Roof Decks where underside of insulation will be exposed install foil-faced flanged-type insulation batts and staple flanges together at maximum 4" centers and seal joints at abutting vertical surfaces with a pressure-sensitive plastic tape. Where underside of insulation will be inaccessible, install secure with spindle anchors. Provide 18 gage galvanized string wires under batts wherever necessary to prevent sagging. Stretch wire taut.

c. Batts In Horizontal or Sloped Applications: Provide tightly stretched string wires along center of horizontal or sloping batts where support spacing exceed 16" on centers.

d. Batts in Ceiling Framing: Install batts between joists, so top of insulation is level with top of framing members. Do not install insulation over recessed lighting fixtures, speakers, or other heat producing elements in ceilings. At junction boxes, access panels, and other items requiring access from above or below ceiling, cut insulation on each side to fit item and install loosely on top. Fit insulation snugly around ducts, conduits, pipes, and other items projecting through ceiling construction.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Roof and non-tapered polyisocyanurate roof insulation.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 07 6000 - Flashing and Sheet Metal.

1.02 REGULATORY REQUIREMENTS

A. Comply with requirements of DSA and authorities having jurisdiction over the Work.

1.03 SUBMITTALS

A. Shop Drawings: Submit roof plans and details. Include roof dimensions, drain and scupper locations, gutter locations, and the layout of insulation boards. Provide details indicating components, attachment and insulation thickness. Provide calculations indicating the average R-value for the system. Indicate drainage patterns and slopes required.

B. Product Data: Submit manufacturer's data substantiating the insulation complies with specified requirements.

C. Installation Instructions: Submit manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. ASTM C 1289 - Faced Rigid Cell Polyisocyanurate Thermal Insulation Board; Type II Class 1 Grade 2.

2. Provide systems complying with requirements for FM Class 1.

3. Provide systems complying with requirements for UL Class A.

4. UL 2818 Green Guard Gold certification. Gold Standard for Chemical Emissions for Building Materials.

B. Installer Qualifications: Minimum five years experience installing specified type of insulation under roofing systems, and certified by the insulation manufacturer to install the Work of this section.

C. Pre-installation Meetings: In accordance with related Division 01 sections, conduct a pre-installation meeting on the Project site.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original sealed and labeled containers.

B. Avoid exposure to sunlight and the elements.

C. Handle materials in a manner to avoid damage or contamination with moisture or foreign matter.

1.06 PROJECT CONDITIONS

A. Environmental requirements:

1. Install products in strict accordance with manufacturer's recommendations.

2. Do not install any materials when water in any form is present on the deck or materials are wet. Do not install any materials if precipitation is forecast and partially completed Work will be left unprotected.

3. Do not install the Work of this section if the temperature of the roof deck is below 40 degrees F.

PART 2 - PRODUCTS

2.01 GENERAL

A. Insulation: Rigid polyisocyanurate foam insulation, with specially formulated organic/inorganic facers as manufactured by:

1. Dyplast Products.

2. Celotex Insulation.

3. GAFTEMP.

4. Sarnatherm (Atlas ACII).

5. Equal.

2.02 DESCRIPTION

A. Tapered Roof insulation shall provide minimum ½" per foot slope and provide minimum insulation values as indicated R21 insulation value.

B. Roof and Deck insulation shall consist of polyisocyanurate foam panels, minimum R-30, U-Factor .038 insulation values, chemically bonded during the foaming process to special organic/inorganic facers on the top and bottom surfaces, and shall conform to the following:

PROPERTIES	**TEST METHOD**	**VALUE**
Compressive Strength	ASTM D 1621	20PSI min.
Dimensional Stability (Thermal and Humid Aging)	ASTM D 2126 (-4 degrees F, amb RH) (158 degrees F, 97 percent RH) (200 degrees F, ambient RH)	 Less than 2 percent linear change Less than 2 percent Linear change Less than 2 percent linear change

Flexural Strength (Modulus of Rupture) (Break load)	ASTM C 203	40 PSI min. 17 PSI min.
Tensile Strength (Perpendicular to surface)	ASTM C 203	500 PSF min.
Water Absorption	ASTM C 209	
Water Vapor Transmission	ASTM E 96	
Core Foam Flame Spread	ASTM E 84	

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify suitability of substrates to receive the Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify suitability of related Work such as the following:

1. Roof drains and scuppers are properly installed.

2. Roof curbs, nailers, equipment supports, vents, and other items penetrating the roof are of the proper height, properly prepared and fastened to the substrate.

3. Concrete surface are sufficiently dry, free from extremes in pH, properly primed and free of fines, edges, or voids.

3.02 INSULATION APPLICATION

A. General:

1. Install the Roof and Deck insulation in accordance with the manufacturer's recommendations and to provide the R values indicated. Butt the panels snugly together.

2. Start boards from either the roof drain or the high point depending on the insulation system. Stencil direction of slope on each board. Stagger joints of underlayment boards from insulation boards.

3. Cut valleys and hips. Field cut crickets from insulation boards. Install valleys, hips, and crickets as required for R values and drainage.

B. Roofing Systems: Fasten insulation with a method recommended by the manufacturer. Method of attachment shall provide a minimum FM I-90 Wind Uplift Rating.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.04 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07 2600

VAPOR BARRIERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Vapor barrier and accessories for installation under concrete slabs.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 3000: Cast-in-Place Concrete.

1.02 REFERENCES

A. American Concrete Institute (ACI) Publication:

1. ACI 302.2R - Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

B. ASTM International (ASTM):

1. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

2. ASTM D1709 - Standard Test Methods of Impact Resistance of Plastic Film by the Free-Falling Dart Method.

3. ASTM E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth under Concrete Slabs.

4. ASTM E1643 - Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill under Concrete Slabs.

5. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s product data and installation instructions for vapor barrier and accessories.

B. Test Reports: Conducted by nationally recognized independent testing agency indicating conformance with specified performance requirements.

1.04 QUALITY ASSURANCE

A. ASTM tests referenced in this Section shall be performed on a single production roll per ASTM E1745 Section 8.1. Submit third party documentation certifying this requirement.

B. Pre-Installation Conference: CONTRACTOR shall coordinate and conduct pre-installation conference in accordance to Section 01 3119, Project Meetings, to review the progress of construction activities and preparations for the installation of vapor barrier.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, handle and protect in accordance with manufacturer's instructions and recommendations.

B. Deliver materials in manufacturer's packaging with labels intact.

C. Store materials in a clean and dry area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Multi-layer plastic extrusion manufactured with high grade prime, virgin, polyolefin resins. Thickness shall be 15 mils minimum.

1. Stego Wrap by Stego Industries LLC.

2. Perminator by W.R. Meadows.

3. Ecoshield-E by Epro.

4. Husky Yellow Guard by Poly-America.

5. Equal.

B. Physical Properties:

1. Maintain permeance of less than 0.01 Perms [grains/(ft^2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Class Rating per ASTM E1745: Class A.

3. Puncture resistance per ASTM D1709: 2200 g or higher.

4. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

C. Accessories: Provide manufacturer recommended accessories for seams, penetrations and perimeter edges, including tapes, mastics, termination for a complete vapor barrier installation per ASTM E1643.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine subsoil and notify Owner's Representative of deficiencies detrimental to proper vapor barrier installation; do not proceed until corrected.

3.02 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643 and manufacturer's instructions.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise, where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself using manufacturer ASTM E1643 compliant accessory designed to adhere to concrete. Seam tape shall not be used for sealing the vapor barrier to the foundation wall, grade beam or slab.

3. Overlap joints 6 inches and seal with manufacturer's seam tape.

4. Seal vapor barrier penetrations per manufacturer's instructions.

5. Avoid the use of non-permanent stakes driven through the vapor barrier.

B. Prior to concrete placement inspect vapor barrier for damage. Clean damaged areas and with vapor barrier material cut a minimum 6 inches larger than damaged area on all sides. Seal to main vapor barrier with continuous seam tape.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Exposed fastener single-skin metal wall panels installed using the screen design principle.

1.1 REFERENCES

A. ASTM International

1. ASTM A240; Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.

2. ASTM A641; Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

3. ASTM A666; Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

4. ASTM A792 – Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy- Coated by the Hot-Dip Process.

5. ASTM B117; Standard Practice for Operating Salt Spray(Fog) Apparatus.

6. ASTM B209; Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

7. ASTM B370; Standard Specification for Copper Sheet and Strip for Building Construction.

8. ASTM C612; Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

9. ASTM C645 – Standard Test Method for Nonstructural Steel Framing Members.

10. ASTM C920 – Standard Specification for Elastomeric Joint Sealants

11. ASTM C1311; Standard Specification for Solvent Release Sealants.

12. ASTM D522; Standard Test Methods for Mandrel Bend Test of Attached Organic Coating

13. ASTM D523; Standard Test Method for Specular Gloss.

14. ASTM D714; Standard Test Method for Evaluationg Degree of Blistering of Paints.

15. ASTM D968; Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive.

16. ASTM D1308; Standard Test Method for Effect of Household Chemicals on Clear and

Pigmented Organic Finishes.

17. ASTM D2244; Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates

18. ASTM D2247; Standard Practice for Testing Water Resistnace of Coatings in 100% Relative Humidity.

19. ASTM D2794; Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

20. ASTM D3359; Standard Test Methods for Measuring Adhesion by Tape Test.

21. ASTM D3363; Standard Test Method for Film Hardness by Pencil Test.

22. ASTM D4145; Standard Test Method for Coating Flexibility of Prepainted Sheet.

23. ASTM D4214; Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films

24. ASTM D5894; Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV/Condensation Cabinet)

25. ASTM E283; Standard Test Method for determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors under Specified Pressure Differences across the Specimen.

26. ASTM E330; Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

27. ASTM E331; Standard Test Method for Water Penetration of Exterior Windows,Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

28. ASTM E1680; Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems.
29. ASTM G153; Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

30. ASTM G154; Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

1.2 SUBMITTALS

A. Product Data: Submit manufacturer current technical literature for each type of product.

B. Delegated Design: Design metal wall panel assembly, submit comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Shop Drawings - Submit detailed drawings showing:

1. Profile
2. Gauge of panel
3. Location, layout and dimensions of panels

4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Installation sequence.
8. Other details as may be required for a weather tight installation

D. Samples: Provide nominal 3 x 5 inch of each color indicated. Provide panel width by 10 inches long minimum.

E. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.

2. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s) and attachment methods, details and required trim and accessories.

F. Closeout Submittals

1. Refer to Section 01 77 00 Project Closeout.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have a minimum of ten (10) years' experience in the production of metal wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.

B. Installer Qualifications: Installer shall be authorized by the manufacturer and the work shall be supervised by a person having successfully completed a manufacturer training seminar regarding proper installation of the specified product.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B. Store wall panel materials on dry, level, firm, and clean surface. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

1.6 WARRANTY

A. Refer to Section 01 78 00 Warranties.

B. Material Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance and finish performance.

1. Warranty Period: Two (2) years from date of Substantial Completion.

C. Finish Warranty: Standard form in which manufacturer agrees to repair or replace metal panels that evidence deterioration of fluoropolymer finish, including flaking or peeling from approved primed metal substrate, chalk in excess of 8 when tested in accordance with ASTM D4214, Method A, and /or color fading in excess of 5 ΔE Hunter units on panels when tested in accordance with ASTM D2244.

1. Warranty Period: Twenty (20) years from date Substantial Completion, or 20 years and 3 months from the date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Morin; a Kingspan Group Company; 685 Middle Street, Bristol, Connecticut 06010- 8416; 1-800-640-9501 (Toll Free); (www.morincorp.us) or equal.

B. Basis of Design: "Exposed Fastener Wall Panels".

C. Substitution Limitations:

1. Submit written request for approval of substitutions to the Architect a minimum of 14 days prior to the date for receipt of bids. Include the following information:

a. Name of the materials and description of the proposed substitute.
b. Drawings, cut sheets, performance and test data.
c. List of projects similar scope and photographs of existing installations.
d. Other information necessary for evaluation.

2. After evaluation by Architect, approval will be issued via addendum. No verbal approval will be given.

3. Substitutions following award of contract are not allowed except as stipulated in Division 01 – General Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal wall panel systems designed to resist the following. Testing shall be done based on ASTM E330:

1. Wind Loads: Determine loads based on the following minimum design wind pressures:

a. Uniform pressure as indicated on Drawings.

2. Deflection Limits: Metal wall panel assemblies shall withstand horizontal deflections no greater than L/180 of the span.

B. Large Missile Impact with Cyclic Pressure: Panels shall successfully pass test standards TAS 201/203 Large Missile Impact with Cyclic inward and outward pressures to demonstrate suitability for High Velocity Hurricane Zone applications with windborne debris.

C. Impact and non-impact testing using uniform static air pressure: Panels shall successfully pass test standard TAS 202 for Testing Impact and Non-Impact Resistant Building Envelope Components using Uniform Static Air Pressure to demonstrate suitability for High Velocity Hurricane Zone applications with windborne debris.

D. Water Penetration under Static Pressure: Provide metal wall panel systems designed to resist penetration of water under static pressure. Testing shall be based on ASTM E331. Wall panels when tested shall have no water leakage at 6 pounds per square foot.

E. Air Infiltration: Provide metal wall panel assemblies designed to resist air infiltration. Testing shall be done based on ASTM E283. Wall panels when tested shall have a maximum air leakage of 0.01 cfm per square feet of fixed wall area at a minimum static air-pressure differential of 1.57 foot pounds per square foot.

F. Finish Characteristics:

1. Gloss: 15 +/- 5 tested in accordance with ASTM D523
2. Pencil Hardness: HB – H tested in accordance with ASTM D3363
3. Flexibility, T-Bend: 1-2T bend tested in accordance with ASTM D4145
4. Flexibility, Mandrel: No cracking tested in accordance with ASTM D522
5. Adhesion: No adhesion loss tested in accordance with ASTM D3359
6. Reverse Impact: No cracking or adhesion loss tested in accordance with ASTM D2794
7. Abrasion Resistance: 65 +/- 10 liters tested in accordance with ASTM D968
8. Graffiti Resistance: Minimal effect
9. Acid Pollutant Resistance: No effect tested in accordance with ASTM D1308
10. Salt Fog Resistance: Passes 1000 hours tested in accordance with ASTM B117
11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours tested in accordance with ASTM D5894
12. Humidity Resistance: Passes 1500 hours when tested in accordance with ASTM D2247 and D714
13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154
14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A
15. Color Tolerances: Greater than 5ΔE units on panels when tested in accordance with ASTM D2244.

2.3 WALL PANEL MATERIALS

A. Aluminum:

1. Coil Stock meeting ASTM B209; Alloy and temper as required for forming operations.
2. Thickness: 0.040 inch.

2.4 WALL PANELS

A. Wall Panel Descriptions:

1. Profile: Y-36
2. Panel Width: 36 inches
3. Thickness: 1 1/2 inch

2.5 ACCESSORIES

A. Wall panel accessories: Provide accessories as required for a complete installation. Accessories shall be as indicated on approved shop drawings and per manufacturer's approved standard details. Match material and finish of metal wall panels.

1. Fasteners: Fasteners with neoprene washers as recommended by manufacturer. Fastener head shall match exposed panel color.
   a. Closure Strips
   b. Closed Cell Closure Strips: Provide minimum 1 inch thick matching metal wall panel profile.
   c. Metal Profile Closure Strips: Shall be fabricated from same gauge, material and finish as metal panel.

B. Trim:

1. Fabricate trim from same material and material thickness as wall panels. Finish to match metal wall panels.

C. Metal Framing:

1. General: ASTM C645, cold-formed metallic-coated steel sheet, G40 hot-dip galvanized, or a protective coating with an equivalent corrosion resistance.

D. Panel Sealant:

1. Joint Sealant: ASTM C920 as recommended in writing by metal wall panel manufacturer.
2. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/8 inch wide and 1/8 inch thick.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.6 FABRICATION

A. Metal wall panels shall be formed to lap with edges of adjacent panels which are then mechanically attached through panel to supports using fasteners with a neoprene washer. Fastener head shall match wall panel finish.

B. Fabricate metal wall panels to eliminate condensation on interior side of panel and with joints between panels designed to form weather tight seals.

C. Panels shall be factory formed. Field formed panels are not acceptable.

D. Curved wall panels: Panels shall be factory curved as approved by manufacturer.

E. Mitered Corners: Structurally bonded horizontal outside or inside trimless corners matching metal wall panel material, profile and factory applied finish shall be fabricated by metal wall panel manufacturer.

1. Welded, riveted or field fabricated corners are not acceptable and will be rejected.

2. Basis of Design: Morin Miterseam Corners (12" x 12")

2.7 FINISHES

A. Aluminum:

1. Finish and Color:

a. Color: Selected from current Morin Metal Wall Panel color chart.
b. Finish System:

1) 1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70%) SOLID color coat.

2) 2.4 mil. Fluropolymer (PVDF) Three Coat system: 0.8 mil primer with 0.8 mil Kynar 500 (70%) SOLID color coat and 0.8 mil clear coat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Provide field measurements to manufacturer as required to achieve proper fit of the metal wall panels to building envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.

B. Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:

1. Plus or minus 1/8 inch in 5 feet in any direction along plane of framing.

2. Plus or minus ¼ inch cumulative in 20 feet in any direction along plane of framing.

3. Plus or minus ½ inch from framing plane on any elevation.

4. Plumb or level within 1/8 inch at all changes of transverse for performed corner panel applications.

5. Verify that bearing support has been provided behind vertical joints of horizontal panel systems and vertical joints of horizontal panel systems. Width of support shall be as recommended by manufacturer.

C. Examine individual panels upon removing from the bundle; notify manufacturer of panel

defects. Do not install defective panels.

3.2 PANEL INSTALLATION

A. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

B. Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C. Cutting and fitting of panels shall be neat, square and true. Torch cutting is prohibited.

3.3 TRIM INSTALLATION

A. Place trim and trim fasteners only as indicated per details on the approved shop drawings.

B. Apply sealant tape at trim, per manufacturer's details and approved shop drawings, for weathertight installation.

3.4 SEALANT INSTALLATION FOR EXPOSED JOINTS

A. Clean and prime surfaces to review exterior exposed sealants in accordance with sealant manufacturer's recommendations.

B. Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.

3.5 CLEANING AND PROTECTION

A. Remove protective film immediately after installation.

B. Touch-up, repair or replace metal panels and trim that have been damaged.

C. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

SECTION 07 52 16.15

SBS MODIFIED BITUMINOUS MEMBRANE ROOFING, COLD-APPLIED

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Section Includes: Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing system on gypsum concrete deck, including:

a. Roof insulation.

b. Insulation cover board.

c. Base sheet.

d. Smooth ply sheet.

e. Mineral granulated cap sheet.

f. Membrane flashing sheets.

g. Roof surfacing consisting of surfacing sheet with top coating.

h. Metal Site Screen Panels.

B. Section includes the installation of insulation strips in ribs of acoustical roof deck. Insulation strips are furnished under Division 05 Section "Steel Decking."

C. Alternates: Refer to Division 01 Section "Alternates" for description of Work in this Section affected by alternates.

D. Allowances: Refer to Division 01 Section "Allowances" for description of Work in this Section affected by allowances.

E. Unit Prices: Refer to Division 01 Section "Unit Prices" for description of Work in this Section affected by unit prices.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site

1. Cold-applied roofing adhesive and surfacer, one-part, formulated for compatibility and use with specified roofing membranes and flashings.

a. Basis of design product: Tremco, POWERply Standard Cold Adhesive.

b. Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

c. Nonvolatile Content, minimum, ASTM D6511: 72 percent.

d. Flash Point, minimum, ASTM D93: 100 deg F (38 deg C).

C. Cap Sheet Adhesive:

1. Cold-applied roofing adhesive and surfacer, one-part, formulated for compatibility and use with specified roofing membranes and flashings.

a. Volatile Organic Compounds (VOC), maximum, ASTM D6511: 250 g/L.

b. Nonvolatile Content, minimum, ASTM D6511: 72 percent.

c. Flash Point, minimum, ASTM D93: 100 deg F (38 deg C).

D. Flashing Sheet Adhesive:

1. Cold-applied one-part butyl-based elastomer adhesive for flashing membranes.

a. VOC, maximum, ASTM D3960: 250 g/L.

b. Adhesion in peel, minimum, ASTM D1876: 3 lbf/in (0.5 N/mm).

c. Lap shear adhesion, minimum, ASTM D816: 18 psi (124 kPa).

d. Color: White.

E. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required by roofing system manufacturer for application.

F. Mastic Sealant: Polyisobutylene, plain or modified bitumen, nonhardening, nonmigrating, non-skinning, and nondrying.

2.6 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing membrane.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roofing components to substrate, tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

C. Stripping Reinforcing Fabric:

1. Woven Glass Fiber Mesh, Vinyl-Coated: Non-shrinking, non-rotting, vinyl-coated woven glass mesh for reinforcing flashing seams, membrane laps, and other roof system detailing.

a. Tensile strength, 70 deg. F, min ASTM D146: Warp, 65 lbf/in (289 N); fill, 75 lbf/in (311 N).

b. Color: Aqua green.

D. Joint Sealant: Elastomeric joint sealant compatible with roofing materials, with movement capability appropriate for application.

1. Joint Sealant, Polyurethane: ASTM C920, Type S, Grade NS, Class 50 single-component moisture curing sealant, formulated for compatibility and use in dynamic and static joints; paintable.

a. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 40 g/L.

b. Hardness, Shore A, ASTM C661: 40.

c. Adhesion to Concrete, ASTM C794: 35 pli.

d. Tensile Strength, ASTM D412: 350 psi (2413 kPa).

e. Color: White.

E. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

F. Miscellaneous Accessories: Provide miscellaneous accessories recommended by roofing system manufacturer.

2.7 ROOF INSULATION MATERIALS

A. Roof Insulation, General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

1. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Roof Insulation:

1. Polyisocyanurate board insulation, ASTM C1289 Type II Class 1 CFC- and HCFC free, with recycled content glass-fiber mat facer on both major surfaces.

a. Basis of design product: Tremco, Trisotech Insulation.

b. Compressive Strength, ASTM C1621: Grade 2: 20 psi (138 kPa).

c. Conditioned Thermal Resistance at 75 deg. F (24 deg. C): 14.4 at 2.5 inches (50.8 mm) thick.

d. A total of R-36 is required to comply with CEC 2019.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches (1:48) unless otherwise indicated.

1. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.8 INSULATION ACCESSORIES

A. Roof Insulation Cover Board:

1. Glass-mat-faced gypsum panel, primed, ASTM C1177/C1177M.

a. Basis of design product: Tremco/GP Gypsum DensDeck Prime.

b. Thickness: 1/4 inch (6 mm).

B. Roof Insulation Adhesive:

1. Cold fluid-applied bead-applied low-rise adhesive, two-component solvent-free low odor elastomeric urethane, formulated to adhere roof insulation to substrate.

a. Flame Spread Index, ASTM E84: 10.

b. Smoke Developed Index, ASTM E84: 30.

c. Volatile Organic Compounds (VOC), maximum, ASTM D3960: 0 g/L.

d. Tensile Strength, minimum, ASTM D412: 250 psi (1724 kPa).

e. Peel Adhesion, minimum, ASTM D903: 17 lbf/in (2.98 kN/m).

f. Flexibility, 70 deg. F (39 deg. C), ASTM D816: Pass.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Tapered Edge Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

E. Substrate Joint Tape: 6- or 8-inch- (150- or 200-mm-) wide, coated, glass-fiber joint tape.

2.9 SURFACING MATERIALS

1. Acrylic Emulsion Coating Material Acrylic Roof Coating, Highly-Reflective Elastomeric: high-solids acrylic latex elastomeric roof coating formulated for use on bituminous roof surfaces; water-based, Energy Star qualified, CRRC listed and California Title 24 Energy Code compliant.

a. Basis of design product: Tremco, ICE Coating.

A. Install stripping according to roofing system manufacturer's written instructions.

B. Acrylic Roof Coating, Highly-Reflective Elastomeric: high-solids acrylic latex elastomeric roof coating formulated for use on bituminous roof surfaces; water-based, Energy Star qualified, CRRC listed and California Title 24 Energy Code compliant

1. Basis of design product: Tremco, ICE Coating.

2. Volatile Organic Compounds (VOC), ASTM D3960: 39 g/L.

3. Emissivity, minimum, ASTM C1370: 0.83.

4. Solar Reflectance Index (SRI), ASTM E1980: 103 (initial) 75 (3 year aged).

5. Reflectance, minimum, ASTM C1549: 84 percent.

6. Solids, by volume, ASTM D5201: 65 percent.

7. Minimum Thickness: 45 mils (1.1 mm) dry film thickness

2.10 METAL WALL PANELS

A. Vertical panel mechanically formed shape. Factory formed symmetrical panels with continuous symmetrical seams.

B. Fasteners color coated to match panel color. Fasteners shall have neoprene washers.

C. Panel Finish:

1. Finish shall be Flurothane Coastal coating using premium fluropolymer (PVDV) system having an extra thick film primer
2. Comply with NAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations for applying and designation of finishes
3. Surfaces shall have protective coverings to help prevent scratches. Film shall be strippable.
4. Noticeable variations in same piece is unacceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize the contrast.
5. Panel Sealants: As recommended by Panel Manufacturer.
6. Flashing and Trim. Shall be fabricated from flat stock in same gauge and color as panel.
7. Color: As selected by Architect
8. Pattern: 7.2 panel
9. Gauge: 24 gauge
10. Hat Channels: 1" by 3" by 16 gauge cold steel formed to shape.

2.11 WALKWAYS

A. Walkway Material and Protection Mat:

1. Walkway pads, ceramic-granule-surfaced reinforced asphaltic composition slip-resisting pads, manufactured as a traffic pad for foot traffic, 1/2 inch (13 mm) thick minimum.

a. Basis of design product: Tremco, Trem-Tred.

b. Flexural Strength at max. load, minimum, ASTM C203: 218 psi (1.5 kPa).

c. Granule adhesion (weight loss), maximum, ASTM D4977: 1.1 gram.
Impact Resistance at 77 deg. F (25 deg. C), ASTM D3746: No Damage to Roof.

d. Pad Size: 36 by 48 inch (914 by 1220 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.

2. Gypsum Cement Roof Deck: Verify that wood deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch (1.6 mm) out of plane relative to adjoining deck.

3. Verify that existing insulation and substrate is sound and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Acoustical Steel Deck Insulation: Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 INSTALLATION, GENERAL

A. Install roofing system in accordance with manufacturer’s written instructions, approved shop drawings, and Contract Documents.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 ROOFING INSTALLATION DETAILS

A. NRCA Installation Details: Install roofing system in accordance with applicable NRCA Manual Plates and NRCA recommendations; modify as required to comply with manufacturer's approved details and perimeter fastening requirements of FM Global references if applicable.

3.5 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.

B. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to membrane roofing system manufacturers' written instructions.

3.6 INSULATION INSTALLATION

A. Comply with roofing manufacturer's written instructions for installing roof insulation.

B. Cant Strips: Install and secure preformed 45-degree cant strips at junctures of built-up roofing with vertical surfaces or angle changes greater than 45 degrees.

C. Tapered Insulation and Crickets: Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.

1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

E. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

F. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

G. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

H. Adhered Insulation Application Method: Install each layer of insulation and adhere to substrate as follows:

a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

I. Mechanically Fastened and Adhered Insulation Application Method: Install first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

a. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.

J. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction. Loosely butt cover boards together. Tape joints if required by roofing manufacturer.

a. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining cover in place.

3.7 COLD-APPLIED ROOFING MEMBRANE INSTALLATION, GENERAL

A. Deck Type: Lightweight concrete filled deck.

B. Base Sheet: One.

a. Adhering Method: Torch applied.

C. Number of Smooth-Surfaced SBS-Modified Asphalt Sheets: One.

a. Adhering Method: Cold-adhesive applied.

D. Granular-Surfaced SBS-Modified Asphalt Cap Sheet:

a. Adhering Method: Cold-adhesive applied.

E. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

F. Cooperate with testing agencies engaged or required to perform services for installing roofing system.

G. Coordinate installation of roofing system so insulation and other components of the roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

a. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing.

b. Remove temporary plugs from roof drains at end of each day.

c. Remove and discard temporary seals before beginning work on adjoining roofing.

H. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.8 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane sheets according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:

1. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

2. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Plan layout to stagger lap seams and end laps. Install roofing membrane sheets so side and end laps shed water. Completely bond and seal laps, leaving no voids.

B. Install Base Sheet in membrane adhesive. Provide full coverage applied at rate recommended by System Manufacturer.

1. Commence layout at low point of roof area.

2. Install lapped base-sheet course, extending sheet over and terminating beyond cants.

3. Lap Seam Treatment: Assure laps are sealed. Apply mastic adhesive and roll using weighted roller in accordance with manufacturer's instructions.

C. Granular Surfaced Cap Sheet:

1. Fully embed sheet in cold-applied membrane adhesive applied at rate required by roofing manufacturer. Roll sheet using weighted roller. Ensure complete and continuous seal and contact between adhesive and membrane without wrinkles, fish mouths, and blisters.

2. Lap Seam Treatment: Adhere side and end lap seams with base sheet overlap adhesive and roll using weighted roller in accordance with manufacturer's instructions.

3.9 PANEL INSTALLATION

A. Wall panels shall be installed vertical and parallel.

B. Joints shall have butyl sealant applied prior to assembly

C. Fasteners shall be installed in straight rows and columns for a geometric appearance.

1. Fasteners shall be set snug but not overtightened. Deformed neoprene washers are an indication of over tightening and will be removed and a replacement fastener installed properly.

3.10 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:

1. Extend base flashing up walls or parapets a minimum of 12 inches (300 mm) above built-up roofing and 6 inches (150 mm) onto field of built-up roofing.

2. Prime substrates with asphalt primer if required by roofing system manufacturer.

3. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive. Apply cold-applied flashing sheet adhesive to back of flashing sheet if recommended by roofing manufacturer. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

B. Seal top termination of base flashing with a metal termination bar.

C. Install roofing membrane cap-sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

D. Install stripping, according to roofing manufacturer's written instructions, where metal flanges and edgings are set on built-up roofing.

1. Flashing-Sheet Stripping: Install flashing-sheet stripping in a continuous coating of cold-applied adhesive and extend onto roofing membrane.

E. Roof Drains: Set 30 by 30 inch (760 by 760 mm) square metal flashing in bed of asphalt roofing cement on completed roofing membrane. Cover metal flashing with roofing membrane cap-sheet stripping and extend a minimum of 6 inch (150 mm) beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

3.11 SURFACING AND COATING INSTALLATION

A. Cold-Applied Adhesive/Surfacer: Coat roofing membrane surface with cold-applied adhesive surfacing adhesive applied at rate required by roofing manufacturer.

B. Aggregate Surfacing: Promptly after installing and testing roofing membrane, base flashing, and stripping, flood-coat roof surface with cold-applied adhesive surfacing adhesive applied at rate required by roofing manufacturer.

1. While adhesive coating is fluid, cast aggregate surfacing in a uniform application at the average weight indicated in Part 2 product listing.

C. Acrylic Emulsion Coating: Apply coating to roofing membrane according to manufacturer's written instructions, by spray, roller, or other suitable application method to provide a dry film thickness of not less than 20 mils.

3.12 WALKWAY INSTALLATION

A. Walkways, General: Install walkways according to roofing manufacturer's written instructions.

1. Install walkways at following locations:

a. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.

B. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size according to walkway pad manufacturer's written instructions.

1. Sweep away loose aggregate surfacing.

2. Set walkway pads in cold-applied adhesive.

C. Walkway Cap Sheet Strips: Install cap sheet strips, approximately 36 inches (900 mm) wide and in lengths not exceeding 10 feet (3 m), leaving a space of 6 inches (150 mm) between strips. Install roofing membrane walkway cap sheet strips over roofing membrane in cold-applied adhesive.

D. Roof-Paver Walkways: Install walkway roof pavers in accordance with requirements of Section 077623 "Roof Pavers."

3.13 WALKWAYS

A. Install walkway pads at all points of access to the roof area(s).
B. Include on pad at each “service side” of mechanical equipment or any other equipment that required periodic servicing.
C. Secure pads in adhesive as recommended by Manufacturer.

3.14 FIELD QUALITY CONTROL

D. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation at commencement and upon completion.

1. Notify Owner 48 hours in advance of date and time of inspection.

B. Repair or remove and replace components of built-up roofing where test results or inspections indicate that they do not comply with specified requirements.

1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.15 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 52 16.15

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Sheet metal flashings in connection with roofing.

2. Reglet and counter flashing assemblies.

3. Miscellaneous metal flashing and counter flashing as required, except where provided under Division 23 or Division 26.

4. Coping caps.

5. Gravel stops and metal edging.

6. Gutters and downspouts.

8. Splash pans where downspouts empty onto roofing.

7. Conductor heads.

8. Drip flashings.

9. Sheet metal wall coverings.

10. Roof pipe flashings.

11. Roof expansion joint covers.

12. Metal louvers not specified in Division 23.

13. Other sheet metal items, not necessarily specified herein or in other sections, but required to prevent penetration of water into building.

C. Related Sections:

1. Section 07 54 19 Poly Vinyl Chloride Roofing

2. Section 07 92 00: Joint Sealants.

3. Section 08 54 13: Aluminum Windows

4. Section 09 24 00: Portland Cement Plaster

5. Division 23: Mechanical.

6. Division 26: Electrical.

7. Section 33 40 00: Storm Drainage

1.02 SUBMITTALS

A. Shop Drawings: Submit for fabricated sheet metal indicating shapes, details, methods of joining, anchoring and fastening, thicknesses and gages of metals, concealed reinforcement, expansion joint details, sections, and profiles.

B. Samples: Submit Samples for materials or assemblies as requested.

C. Product Data: Submit brochures of manufactured items.

1.03 QUALITY ASSURANCE

A. Drawings and requirements specified govern. Provide the Work of this section in conformance with the Architectural Sheet Metal Manual published by SMACNA for conditions not indicated or specified and for general fabrication of sheet metal items.

B. Materials shall conform to following standards:

1. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.

2. ASTM A 653 - Sheet Steel, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM B 370 - Copper Sheet and Strip for Building Construction.

4. ASTM B 749 - Lead and Lead Alloy Sheet, Strip and Plate Products.

C. Pre-installation Meetings: Refer to Division 7 roofing sections as appropriate. Attend the pre-installation and inspection meetings for roofing Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install bent and/or otherwise damaged materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Sheet Steel: ASTM A 653, coating designation G90, hot-dip galvanized.

B. Copper Plate, Sheet and Strip: ASTM B 370, cold-rolled, tempered. Copper sheet and strip shall be cold-rolled-temper.

C. Sheet Lead: ASTM B 749, Type L50049 or L51121, weighing not less than 4 pounds per square foot.

D. Stainless Steel: Plate, sheet and strip shall conform to ASTM A 167, Type 304 or Type 316, No. 4 finish on exposed surfaces and No. 2 finish on concealed surfaces unless otherwise specified or indicated. Furnish Type 304 for general applications and Type 316 where exposed to acidic or alkaline conditions.

E. Fastenings:

1. Galvanized Steel: Nails, rivets, and other fastenings furnished in connection with galvanized sheet steel Work shall be sealed with rust resistive coating. Rivets shall be tinned. Nails and other fastenings shall be zinc-coated.

2. Copper: Nails, rivets, and other fastenings furnished in connection with copper sheet metal Work, shall be manufactured from hard-temper copper or hard brass.

3. Stainless Steel: Nails, rivets and other fastenings furnished in connection with stainless steel Work, shall be 300 series alloy to match alloy of stainless steel being fastened.

F. Soldering Flux: Raw muriatic acid for galvanized steel; rosin for tin, lead and tinned copper; non-corrosive soldering salts for uncoated copper and acid-type flux formulated for soldering stainless steel.

G. Solder: ASTM B 32, Grade 50A. Name of product manufacturer and grade designation shall be stamped or cast onto each bar.

2.02 FABRICATION

A. General:

1. Accurately form sheet metal Work to dimensions and shapes indicated and required. Cope finish molded and brake metal shapes with true, straight, sharp lines and angles and, where intersecting each other, to a precise fit. Unless otherwise specified, all galvanized sheet steel shall be 22 gage. Exposed edges of sheet metal shall have a 1/2 inch minimum hemmed edge.

2. Soldering of sheet steel or copper shall be performed with well-heated copper soldering iron or soldering torch, joints full flowing, neat and consistent. Thoroughly clean materials at joints before soldering, and tin coppers before soldering. Exposed soldering on finished surfaces shall be scraped smooth. Lock seam Work shall be fabricated flat and true to line and soldered along its entire length. Acid-fluxed Work shall be neutralized after fabrication.

3. Form and install sheet metal Work to provide proper allowances for expansion and contraction, without causing undue stresses in any part of completed Work. Installation shall be water and weathertight.

B. Gutters and Downspouts:

1. Gutters: Fabricate from 22 gage galvanized steel to match existing size and design unless otherwise indicated. Drain gutter towards nearest downspout and provide an expansion joint at mid-point between downspout outlets, but not to exceed 50 feet on center. Gutters shall not pond water. Rivet joints and ends with a minimum of 6 rivets per joint or maximum rivet spacing not to exceed 1-1/2 inch on center. Sweat solder from inside of gutter and in horizontal position where possible. Neatly fit downspouts to gutter using a slip joint. Provide expansion joints, consisting of 3 inch lap joints at not over 30 feet.

2. Form and install sheet metal Work to provide allowance for expansion and contraction without causing undue stresses in the completed Work.

3. Downspouts: Fabricate downspouts from 3 inch round, or 3 inch by 4 inch rectangular shapes, 16 gage steel tubing with butt joints and mitered elbows, sized as indicated. Downspouts exceeding 30 feet in length may be fabricated with a slip joint or leader head. Downspout shall be fabricated with elbows at bottom discharge or connected to drains as indicated. Joints, except expansion joints shall be sealed with a continuous weld. Galvanize downspouts after fabrication.

4. Outlets: Fabricate outlets of 22 gage galvanized sheet steel with a 1/4 inch rolled flanged soldered continuously to gutter. Outside diameter shall be 1/8 inch less than the diameter of the downspout and extend into downspout 3 inches. Install a 1/4 inch galvanized rod over center of outlet opening, lapping 1 inch over each side of outlet and soldered in place. Galvanize rod after fabrication, before installation.

C. Conductor Heads:

1. Fabricate conductor heads and outlets from 22 gage galvanized sheet steel. Cover tops of the conductor heads with 22 gage galvanized 1/4 inch wire mesh soldered securely to separately fabricated frame and mechanically fastened to top conductor head with a minimum of 2 fasteners.

D. Gravel Stops: Provide 24 gage galvanized sheet steel gravel stops wherever roof area drops to a lower level; at the eaves and rake of roof, where roof comes to an abrupt edge, and where indicated. Stops shall be of height indicated and shall be fabricated with 2 flanges. Horizontal flange shall be not less than 4 inches wide, and vertical flange shall extend down over vertical surfaces of trim or gutter. Gravel stops shall lap 4 inches at ends and corners, and shall be fabricated by notching and interlocking vertical face flanges. Contact surfaces of lapped flanges, including raised areas, vertical face and corners, shall be completely covered with flashing compound. Fabricate lap joints so that they will be in the direction of water flow. Where flanges are over 5 inches wide, provide 20 gage continuous cleats fastened at 24 inches on center.

E. Overflow Outlets: Provide galvanized sheet steel overflow outlets at locations and of sizes indicated. Outlets shall extend through full thickness of wall in one continuous piece and completely line the opening. On outside face of wall, top and sides of outlet shall finish 1/2 inch on surface of wall. Bottom of outlet shall project 1-1/2 inch beyond face of wall, and shall be bent down slightly. Outlets shall be sealed on the surface of the building. On inside face, side and bottom flanges shall extend not less than 8 inches beyond edge of opening, and not less than 6 inches at top. Outlets shall be installed at time roof is being installed.

F. Reglet Type Counterflashing: Where roof comes in contact with vertical surfaces, provide counterflashing. Set top of counterflashing 8 inches above roof deck unless otherwise indicated, and extend down at least 5 inches or to top of cant strip. Counterflashing and reglet shall be 22 gage galvanized sheet steel. Lap counterflashing and reglet 3 inches minimum at splices and miter at angles, or supply special metal corner fittings. Reglet and method of securing flashing shall be so constructed that flashing is firmly locked in place, but may be readily removed for replacement.

G. Splash Pans: Provide splash pans for all downspouts, which empty onto lower roofs. Pans shall be galvanized sheet steel 12 inches by 18 inches, unless otherwise indicated, and turned up 2 inches on at least 3 sides.

H. Roof Expansion Joint Covers: Fabricate of 22 gage galvanized sheet steel, as detailed. One side of joint shall be zee shaped, with 3 inch standing leg extended over the joint and turned down. The other side shall be box shaped, fabricated to extend over the joint, over the standing leg, and turn down to form a water barrier. Prefabricated bellows type joint covers are not permitted.

I. Louvers, Fixed: For sizes 2’ x 3’ maximum (Provide heavier gages as required for sizes indicated on Drawings).

1. Gages: #22 gage for spans to 24”, #20 gage for spans to 36”.

2. Type: Similar to SMACNA Plates #102, #103A-2 frame, #103D-1 louvers, folded U-frame Plate #108B

a. Insect Screen: 8 mesh with #27 gage galvanized wire

J. Miscellaneous Flashing: Unless otherwise indicated, miscellaneous flashing shall be fabricated of galvanized steel. Exterior doors and windows, unless covered by overhangs shall be provided with 22 gage galvanized steel drip flashing as detailed.

K. Sheet Metal Wall Covering: Wall surfaces, where indicated, shall be covered with sheet metal to height indicated. Metal covering shall be 24 gage galvanized sheet steel, with joints between sheets occurring only over studs. Joints locked together and rolled flat. Exposed edges of sheet metal shall be hemmed at least 1/2 inch. Nail sheets in field along studding at 12 inches on center, and at top and bottom edges and seams at 4 inches on center, using 3d galvanized nails.

L. Roof Pipe Flashings: Provide welded seam 4 pound lead flashings. Field fabricated flashings shall also be welded.

PART 3 - EXECUTION

3.01 PREPARATION

A. Concrete and masonry materials in contact with sheet metal shall be painted with alkali resistant coating, such as heavy-bodied bituminous paint. Wood in contact with sheet metal shall be painted with 2 coats of aluminum paint or one coat of heavy-bodied bituminous paint.

3.02 INSTALLATION

A. General: Coordinate with installation of underlayment indicated in the Drawings and specified in Section 09220.

B. Gutters and Downspouts:

1. Anchor gutters to structure with 10 gage steel straps, galvanized after fabricating. Secure straps with galvanized fasteners at 3 feet on center. Drill pilot holes and use 12 x 2 inch pan head screws.

2. Install 1/4 inch galvanized wire mesh continuous cover on gutter where indicated.

3. Secure downspouts to walls with 1/8 inch x 2 inch galvanized steel straps. Straps shall be located at top, bottom, and at not over 10 feet on center. Block downspouts out 1/2 inch from the finish wall surfaces. Secure straps to wall framing with 1/4 inch by 2 inch long galvanized anchors. Expansion type anchors shall be provided when anchoring to concrete and masonry. Provide toggle bolts for attachment to masonry or plaster. At steel columns, provide fasteners as indicated. Plastic anchors are not permitted.

4. Anchor conductor heads to walls with 1/4 inch x 2-1/2 inch galvanized lag screws or 1/4 inch expansion type anchors.

C. Reglets: Install reglets at constant height above cant or as indicated. Provide minimum 3 inch lap at end splices of reglets. Caulk laps solidly.

D. Counterflashing:

1. Install at constant horizontal elevation across roof slope and slope at constant height above cant or as indicated.

2. Provide minimum 3 inch lap at all end splices of counterflashing.

E. Galvanized sheet steel parapet coping and flashing shall be continuous over top of parapet to form a watertight cap, with waterproof seams at approximately 10 feet on center, or as indicated. Anchor coping to outside of wall with a continuous cleat face nailed at 24 inch centers. Coping shall be fastened on inside wall with hex head screws and bonded sealing washers through oversized holes in the back of the coping. Corners and angles shall be lapped and soldered; do not install joint sealant.

F. Prefabricated Louvers: Install plumb and level; securely anchor; seal watertight to adjoining construction. Install screens, cranks, and blackout plates where required.

3.03 TESTING

A. Perform field water testing to demonstrate installation is watertight. Continue testing with a continuous hose stream applied at base of installation for at least 30 minutes. If leaking is observed, discontinue test and repair installation, then test until satisfactory results are obtained.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

1.1 WARRANTY

A. Painted Finishes: 10 years.

1.2 PRODUCTS

A. Roof Curbs.

1. Height: Minimum 12 inches (300 mm)
2. Material: Zinc-coated (galvanized) steel.
3. Finish: Factory prime coating.
4. Integral spring-type vibration isolators.
5. Security grille where indicated.

B. Equipment Supports:

1. Height: Minimum 12 inches (300 mm).
2. Material: Zinc-coated (galvanized) steel.
3. Finish: Factory prime coating.
4. Security grille where indicated.

C. Pipe Supports.

D. Preformed Flashing Sleeves: Exhaust vent flashing fabricated from aluminum sheet.

E. Roof Hatch

F. Fall Protection

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Roof Hatches:

1. Babcock Davis.

2. Bilco Company.

3. Lane-aire Model CRH.

4. Dur-Red Products.

2.02 PRODUCTS

A. Roof Hatches: Provide roof hatches of indicated sizes. Hatches shall be fabricated of galvanized steel, 14 gage curb and cover, 22 gage cover liner, and 1 inch thick insulation in cover and curb. Cover shall operate by a compression spring enclosed in a telescopic case or enclosed torsion spring, with automatic hold-open arm. Provide padlock hasp on inside of unit.

B. Accessories: Provide manufacturers collapsible hatch railing system, providing a temporary means of fall protection for roof hatch openings. Rail system shall meet OSHA Standard 29 CFR 1910.23

C. Fall Protection: Guardian Fall Protection, S-Anchor, Part number 00690. Worker Capacity Range: 130 – 420 pounds, Galvanized Steel, 5,000 Lbs. minimum breaking strength. Meets ANSI/ISEA 125-2014. Performance Std. ANSI 2539, 18-2017, OSHA 1910, OSHA 1926 Subpart M.

END OF SECTION

SECTION 07 81 23

INTUMESCENT FIREPROOFING FOR STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Thin-film Intumescent fire resistive coating.

B. Basecoat (where required)

C. Protective decorative topcoat.

1.02 RELATED SECTIONS

A. Section 01 50 00: Construction Facilities and Temporary Controls.

B. Section 05 12 00: Structural Steel for steel substrates.

C. Section 07 84 00: Firestopping and Smoke Seals.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E 119, Standard Methods for Fire Tests of Building Construction and Materials.

2. ASTM D2240, Standard Test Method for Rubber Property - Durometer Hardness.

3. ASTM D2794, Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

4. ASTM D3960, Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

5. ASTM D4060, Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abrader.

6. ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials.

7. ASTM E595, Standard test Method for Total Mass Loss and Collected Volatile Condensable Materials from Out-gassing in a vacuum Environment.

8. ASTM E736, Standard test method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

9 ASTM E759, Standard test method for Effect of Deflection on Sprayed Fire-Resistive Materials Applied to Structural Members.

10. ASTM E761, Standard test method for Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

B. Association of the Wall and Ceiling Industries - International (AWCI):

1. AWCI *Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide*.

C. Underwriters Laboratories Inc. (ULI):

1. Fire Resistance Directory, Volume 1, current edition.

D. Intertek Testing Services / Warnock Hersey International, Inc. (ITS/WH):

1. Directory of Listed Products, current edition.

E. Factory Mutual Research (FM):

1. Approved Products Guide, current edition.

1.04 SYSTEM DESCRIPTION

A. Thin-film intumescent fire-resistive coating system shall provide a fire resistance rating:

1. Steal Beam: 1 hour.

1.05 SUBMITTALS

A. General: Submit listed submittals in accordance with conditions of the contract and Division 01 33 00 Submittal Section.

B. Product Data: Submit product data including manufacturer's Spec Data sheet, for specified products Include product data indicating product characteristics, performance and limitation criteria.

C. Quality Assurance Submittals: Submit the following:

1. ULI published test designs for fire resistive coating application to substrate materials required and test reports showing compliance with specified physical performance characteristics and physical properties.

2. Manufacturer's Instructions: Manufacturer's installation instructions.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Company specializing in manufacturing products of this section for a minimum of 10 years.

2. Company's quality management system shall have been assessed and registered by an independent registrar as conforming to the requirements of the standard ISO 9001:1994.

B. Applicator (Installer):

1. Applicator: Approved, trained and/or supervised by manufacturer of fire resistive coating materials Company with minimum five years experience.

C. Product Qualifications:

1. Manufactured under ULI, ULC, ITS/WH and/or FM Follow-up Programs. Each container or package shall bear ULI, ULC, ITS/WH and/or FM label.

D. Field Inspection:

1. An independent testing laboratory/company shall test random samples as applied, to verify thickness of thin-film intumescent fire-resistive coating in accordance with *AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire Resistive Materials; an Annotated Guide.* Inspection shall be carried out immediately following final thickness of A/D FIREFILM®II and just before application of A/D COLORCOAT® topcoat.

E. Regulatory Requirements:

1. Conform to applicable CBC code for 1/Hr. fire resistance ratings.
Submit certification of acceptability of fire resistive coating materials to Architect and DSA.

1.07 DELIVERY, STORAGE AND HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Ship, store and deliver at temperatures not less than 50°F (10°C); protect from freezing!

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1. Store materials at a temperature not less than 50 degrees F (10 degrees C) in a dry, protected area, off ground in original, undamaged, sealed containers with manufacturer' s labels and seals intact.

2. Protect from freezing.

3. Do not store in direct sunlight.

4. Check freeze-watch indicators before accepting delivery of A/D FIREFILM®II and/or A/D BASECOAT.

5. Discard any materials that have come into contact with contaminants prior to actual use.

6. Check "Freeze-Watch" indicators before accepting delivery of A/D FIREFILM®II.

7. Discard any materials which have come into contact with contaminants prior to actual use.

1.08 PROJECT / SITE CONDITIONS

A/D FIREFILM®II and A/D BASECOAT are sensitive to moisture and must be protected from moisture during the entire application and drying period, until completely dried and top coated with A/D COLORCOAT. Ambient air and steel temperatures must not be less than 50 degrees F (10 degrees C). High humidity at the site will hinder drying and recoat/top coat times. A/D FIREFILM®II and A/D BASECOAT must be dry before recoating and/or top coating. Inadequate drying between coats or application during high humidity conditions can cause softening of previous coats and/or delamination. Relative humidity of 40 - 60 % in the work area is recommended. Temporary enclosures, heat and moisture control may be required to maintain acceptable conditions. Electric heat is recommended where supplemental heat is required. Industrial dehumidifiers are recommended to control humidity. A source of dehumidifiers / heaters is Munters Moisture Control Services, (800) I-CAN-DRY, (508) 388-4900. Air movement and thinner coats will assist drying.

A. Environmental Requirements/Conditions: Substrate and ambient air temperature shall be in accordance with manufacturer's requirements.

1. Protect work area from windblown dust and rain. Protect adjacent areas from over spray.

2. Provide ventilation in areas to receive work of this section, during application and 24 hours (minimum) after application.

B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in spaces where products will be installed for a time period before, during and after installation as recommended by manufacturer.

1. Do not apply thin-film intumescent fire-resistive coating when temperature of substrate and/or surrounding air is below 50°F (10°C). Use electric heat if supplemental heat is required.

2. Relative humidity of 40% to 60% is recommended in work area. Relative humidity in work area must not exceed 75% throughout the total period of application and drying for the intumescent coating, and must not exceed 65% throughout the application and drying for the protective decorative finish coat.

3. Manufacturer's recommended temperature and humidity conditions must be maintained throughout the entire application and drying period until intumescent coating and basecoat (if required) are fully dried and top coated, including any interim period prior to application of the top coat.

1.09 SEQUENCING AND SCHEDULING

A. Sequencing: Sequence work in conjunction with [ceiling hanger tabs,], sprinkler pipes, HVAC systems and other mechanical systems and cementitious fire proofing and gypsum board works.

B. Do not apply thin-film intumescent fire-resistive coating until concrete toppings and/or roofing applications have been installed.

C. Steel surfaces with less than 3 feet (1 meter) clear working access may necessitate the application of materials to inaccessible surfaces prior to erection of the finished steel members, either at the point of fabrication or on-site.

D. All interior exposed and semi-exposed structural steel to receive thin-film intumescent, except for braces.

PART 2 - PRODUCTS

2.01 THIN-FILM INTUMESCENT FIRE-RESISTIVE COATING

A. Manufacturer: A/D Fire Protection Systems or approved equal.

Contact: 420 Tapscott Rd., Scarborough, Ontario M1B 1Y4; Telephone: (800) 263-4087 or (416) 292-2361; Fax: (416) 298-5887; www.adfire.com

B. Primer: Select primer from manufacturer's list of approved primers, or other only as approved by A/D Fire Protection Systems.

C. Basecoat: A/D BASECOAT by A/D Fire Protection Systems (for use in conjunction with ULI Designs X640 and X644, ITS/WH Designs AD/CA 120-02 and AD/CA 180-02, ULC Designs Z609 and Z616 and Factory Mutual Column Protection Methods 3 and 4).

D. Top Coat: A/D COLORCOAT by A/D Fire Protection Systems.

E. Product (s)/Systems (s) Testing: [Listed by ULI and bearing the UL label] [Listed by WH and bearing WH label] [Listed by FM and bearing the FM mark].

2.02 MATERIALS

A. Fire Resistive Coating Material: Thin-film, intumescent coating: A/D FIREFILM®II as manufactured by A/D Fire Protection Systems ANSI/UL 263 (BXUV) design X661 for interior application and Nullifire S605 for exterior application.

1. Water based.

2. Hardness (Shore "D"): Durometer D81.8, creep 1 at 15 s, 230 degrees C.

3. Surface Burning Characteristics (ASTM E84): Flame Spread: 0 -20, Smoke Development: 0-50, Class "A".

4. Density 1,366 g/l.

5. Dry Weight: 0.46 lb/ft2 (2.2 kg/m2) at 65 mil (1.6 mm) dry.

6. Cohesion / Adhesion (Bond or Tensile) (ASTM 736): 10,886lbf/ft2 (3.24 kgm2) at 120 mil (3 mm) dry.

7. Compressive strength (ASTM E761): 157,680, lbf/ft2 (7.6 MPa) at 10 % deformation.

8. Deflection Resistance (ASTM E759): Pass with out spalling, cracking or delaminating.

9. Impact Resistance (ASTM D2794): 286 in-lb (3.3 kg-m) (direct) at 120 mil (3 mm), 123 in-lb (1.4 kg-m) (direct) with A/D COLORCOAT over A/D FIREFILM®II at 65 mil (1.6 mm).

10. Abrasion Resistance (ASTM D4060): 508 cycles per mil at 65 mil (1.6 mm) dry

11. Off gassing (ASTM E595): TML 0.82, CVCM 0.00, WVR 0.49), NASA SP-R-0022A and ESA PSS-01-702.

2.03 MIXING

A. A/D FIREFILM®II and A/D BASECOAT are shipped pre-mixed from the factory. Mix gently in order to minimize introduction of air to the product. Do not add water or solvent.

B. Mix A/D COLORCOAT by boxing and stirring. Do not add water or solvent.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including technical bulletins, product catalogue, application instructions and product markings for installation.

3.02 EXAMINATION

A. Site Verification of Conditions:

1. Examine surfaces to receive work of this Section and report any defects, which may affect the work of this section. Identification marking of steel components must be by wax crayon to facilitate ease of removal prior to application of this intumescent fireproofing.

2. Verify that substrate surfaces are ready to receive work. Commercial Blast Cleaning (SSPC-SP6/NACE No.3) is recommended for minimum surface preparation. Weld flashes should be ground smooth prior to commencement of application.

3. Verify that all clips, hangers, sleeves and similar devices have been attached. Confirm compatibility of surfaces to receive fireproofing materials. Steel surfaces must be primed with a compatible primer - see 2.1.B.

4. Beginning of installation means acceptance of (existing surfaces) (substrate).

5. Verify substrate and workspace temperature and humidity conditions are in accordance with manufacturer's recommendations - see 1.8.

3.03 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent surfaces, work areas, finish surfaces and equipment from over-spray/damage during product application.

B. Surface Preparation: Clean substrate free of dust, dirt, grease or other foreign matter which would impair bond of fire resistance material.

1. Comply with Commercial Blast Cleaning (NACE No. 3 / SSPC SP6) for minimum surface preparation.

2. Weld flashes shall be ground smooth prior to commencement of application.

3.04 INSTALLATION

A. General: Apply A/D FIREFILM®II and A/D BASECOAT in accordance with manufacturer's instructions in sufficient thickness to achieve required fire resistance rating. Spray application is recommended. A/D BASECOAT is to be applied by spray only. Apply A/D COLORCOAT decorative finish according to manufacturer's recommendations.

B. Priming: Apply A/D FIREFILM®II and A/D BASECOAT only to primed surfaces. Use only primer as approved by A/D Fire Protection Systems. Follow primer manufacturer's instructions.

C. Application Rates and Thickness Measurements:

1. Comply with fire test designs or A/D FIREFILM®II thickness selection tables for determination of dry film thickness of A/D FIREFILM®II and A/D BASECOAT (where required) required for size of steel element to be protected and for required fire resistance rating (s). Apply A/D COLORCOAT topcoat.

2. Apply A/D FIREFILM®II at a maximum rate of 30 mil (0.76 mm) wet or approximately 23 mil (0.58 mm) dry per coat. Apply A/D BASECOAT at a maximum rate off 60 mil wet per coat.

3. Final dry film thickness must be measured with a dry-film thickness gauge. Do not apply A/D COLORCOAT until it has been determined that the required dry film thickness of A/D FIREFILM®II and A/D BASECOAT (where required) have been provided. For method of thickness determination refer to *AWCI Technical Manual 12-B, Standard Practice for the Testing and Inspection of Field Applied Thin-Film Intumescent Fire-Resistive Materials; an Annotated Guide*.

D. Application:

1. Spray Equipment: Use spray application for best coverage, finish and appearance. For A/D FIREFILM®II, use an airless sprayer capable of 3000 psi pressure, minimum, without surging. For A/D BASECOAT, use sprayer capable of 4000 psi pressure, minimum, without surging. Remove all filters except pump filter. For A/D FIREFILM®II use a 3/17 to 4/23 size, heavy-duty type, self-cleaning (reversible) tip. For A/D BASECOAT, use a 23 mil (0.58 mm) tip. Adjust pressure and distance between tip and surface to minimize orange peel. Adjust fan width to minimize over spray. Use a 15 mil (0.38 mm) tip for A/D COLORCOAT.

   Note: Due to the relatively high solids content, it can be difficult to attain high builds and/or a smooth finish when applying A/D FIREFILM®II by brush or roller. High points can be removed with a paint scraper or utility blade. Low points can be filled and the finish smoothed by applying A/D FIREFILM®II with a drywall knife or trowel. A putty grade is available for this purpose.

2. Hand Application: Use a brush recommended for use with latex paint and a low pile roller to apply A/D FIREFILM®II .Use a China bristle brush or roller to apply A/D COLORCOAT. Apply A/D BASECOAT by spray only.

   Note: A/D FIREFILM®II and A/D BASECOAT have been formulated to dry quickly. A viscosity increase will be experienced after a pail is opened. Keep pail covered as much as possible during the application process to minimize evaporation.

3. Handling: When applying by brush or roller, work from a small container, mixing frequently. Keep original pail tightly closed with the surface of the material covered by the plastic sheet provided.

4. Drying and Recoat Time: Drying time will vary with temperature and humidity conditions. Apply next coat of ff or A/D BASECOAT only after previous coat is dry.

E. A/D COLORCOAT Application:

1. A minimum of 24 hours is recommended between application of the final coat of A/D FIREFILM®II and application of A/D COLORCOAT. Recommended Site Conditions (see 1.8) must be maintained for any interim period after final coat of A/D FIREFILM®II and until A/D COLORCOAT has been applied and dried. A/D FIREFILM®II must be dry before application of A/D COLORCOAT. Do not apply A/D COLORCOAT until it has been determined that the required dry film thickness of A/D FIREFILM®II has been provided.

2. Thickness; Apply A/D COLORCOAT to a minimum dry film thickness of 2 - 4 mil (0.05 - 0.10 mm).

F. Patch and repair any fire resistive coating that has been damaged in accordance with patching recommendations of material manufacturer. If coating becomes damaged, rebuild thickness by spray or brush. Fill small areas with trowel. When dry, smooth and finish with A/D COLORCOAT to match.

3.05 CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions. Remove and legally dispose of construction debris.

3.06 PROTECTION

A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 07 84 00

FIRE STOPS AND SMOKE SEALS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

2. Mineral fiber insulation, fire safing, and safing edge of floor slabs and curtain walls.

3. Damming material, clips, and closures.

4. Gaps between the top of walls and ceilings or roof assemblies.

5. Expansion joints in walls and floors.

6. Openings around structural members which penetrate floors or walls.

C. Related Sections:

1. Section 03 30 00: Cast-in-Place Concrete.

2. Section 04 22 00: Concrete Unit Masonry.

3. Section 07 21 00: Thermal Insulation.

4. Section 07 92 00: Joint Sealants.

5. Division 8: Doors, Windows and Frames

7. Section 09 29 00: Gypsum Board.

8. Division 23: Mechanical.

9. Division 26: Electrical.

10. Division 27: Low Voltage Systems.

1.02 REFERENCES

A. ASTM Standards:

1. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

4. ASTM E1399 – Standard Test Method for Cyclic Movement and Measuring Minimum and Maximum Joint Widths on Architectural Joint Systems.

5. ASTM E1966 – Standard Test Methods for Fire-Resistive Joint Systems.

B. Underwriters Laboratories, Inc.

1. UL 263 – Standard for Fire Tests of Building Construction and Materials.

2. UL 723 – Standard for Test for Surface Burning Characteristics of Building Materials.

3. UL 1479 – Fire Tests of Through Penetration Firestops.

4. UL 2079 – Test for Fire Resistance of Building Joint Systems.

5. UL Fire Resistance Directory.

C. Intertek Testing Services:

1. Intertek - Certification Listings.

D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

E. California Building Code, Chapter 7 Fire Tests of Through-Penetration Fire Stops.

1.03 SYSTEM DESCRIPTION

A. Provide fire stops and smoke seals to prevent the passage of fire, smoke, toxic gasses or water from one floor or area to another. Seal openings in floors, fire rated walls and permanent partitions penetrated by pipes, ducts, conduits and other items as shown, specified, and as required for the type of construction.

B. Mineral fiber insulation installed as fire safing at non-rated penetrations not containing pipes, ducts, conduits, and other items in floor slabs, wall partitions, construction-joint conditions between slabs and adjacent construction and where indicated or required.

C. Provide damming material, clips, and closures as required for support and containment of dams, and other insulation materials required for tested and rated fire stop systems.

1.04 QUALITY ASSURANCE

A. Performance Criteria:

1. Provide materials and Work to conform to source quality control criteria specified herein and CBC requirements in fire resistant wall and floor assemblies to prevent the passage of fire, smoke, and toxic gases.

2. Installed fire stops 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.

B. Comply with CBC requirements for fire rated construction.

C. Qualifications of Manufacturer: Products furnished for fire stopping and smoke seals shall be manufactured by a firm which has been continuously and regularly employed in the manufacture of these materials for a period of at least 5 years; and which can provide evidence of these materials being satisfactorily installed on at least 5 projects of similar size and type within such period.

D. Qualifications of Installer: The Work of this section shall be installed by a firm which has been in the business of installing similar materials for at least 5 consecutive years; and can provide evidence of satisfactory completion of 5 projects of similar size and scope. Installer shall have applicators trained and certified by manufacturer for performing this Work.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.

1.05 SUBMITTALS

A. Product Data:

1. Submit manufacturer's Product Data for each type of fire stop and smoke seal material proposed for installation. Indicate product characteristics, typical installations, performance, and limitation criteria and test data.

2. Submit manufacturer's printed installation instructions for each type of product, system, and construction required for the Work. Indicate fire resistance rating of each installation.

3. Submit fire test reports from independent testing agency indicating the following:

a Fire test report of fire stop material installed to substrate and penetration materials similar to the Work of this section. Test to indicate both Fire Resistance (F) and Temperature (T) Ratings.

b Test reports of products to be installed shall indicate conformance to ASTM E814, UL rating with UL classified system description, and UL classified system detail.

c. Test reports of products to be installed shall indicate conformance to systems included in the Intertek Directory.

B. Field Samples: No less than 10 days before commencing the Work of this section, provide field installed Samples of fire stop materials and systems.

1. Apply one Sample of fire stop material for each different penetration and related fire rating required for the Work.

2. Sample areas shall comply with thickness, fire resistance ratings, and finished appearance.

C. Manufacturer's Qualifications: Submit evidence of conformance with qualification requirements specified above.

D. Installer's Qualifications: Submit evidence of conformance with qualification requirements specified above.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the Project site in manufacturer's original, unopened containers bearing correct UL labeling.

B. Fire stop material shall be stored above grade in an area protected from detrimental weather and moisture conditions and in compliance with manufacturer's requirements, including temperature restrictions.

C. Fire stop and seal materials shall be installed before expiration of shelf life.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Unless otherwise noted, products of this section shall be as manufactured by:

1. 3M Fire Protection Products.

2. Hilti, Inc.

3. Nelson Firestop Products..

4. Tremco, Inc.

5. Or Equal.

B. Provide materials and systems of specified manufacturers to suit penetration and substrate as determined by various conditions of installation.

C. Provide firestopping composed of components that are compatible with the substrates forming openings and the items penetrating the firestop, under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.

2.02 MATERIALS

A. Cast-in Firestop Devices: Pre-installed firestop devices penetrating concrete over metal decks, for use with combustible and non-combustible pipe, (closed and open systems) insulated pipe, conduits and cable bundles. Provide metal deck adapters and top seal plugs.

1. 3M: Fire Barrier Cast-in-Place Devices.

2. Hilti: CP 653 Speed Sleeve; CP 680 Cast-in-Place FS Device; -

3. Tremco: CIPP Plastic, CIPP Metal.

4. Nelson Firestop Products

B. Firestop Collar: Made of galvanized steel housing and Intumescent inserts for firestopping combustible pipes through walls and floors. For use with concrete, masonry, and gypsum wall assemblies. Provide two collars on walls, one on each side, and one collar on underside of floors.

1. 3M: Plastic Pipe Device PPD.

2. Hilti: CP 643N and CP 644.

3. Tremco: TREMstop D.

4. Nelson Firestop Products: PCS Pipe Choke System.

C. Fire Block: Intumescent flexible block based on a two component foam, for use in walls and floors and concrete, masonry and gypsum wall assemblies. For large openings containing multiple penetrations: wall openings up to 48 inches by 48 inches and floors up to 36 inches by 36 inches.

1. 3M: Fire Barrier Self-Locking Pillow.

2. Hilti: FS 657.

3. Tremco: TREMstop PS1, TREMstop PS2.

4. Nelson Firestop Products: Fire Brick, Pillows.

D. Firestop Mortar: Fire-resistant mortar suitable for fireproofing large horizontal or vertical, concrete or masonry openings penetrated by single or multiple non-combustible pipes or cable trays.

1. 3M: Fire Barrier Mortar.

2. Hilti: CP 637.

3. Tremco: TREMstop Mortar.

4. Nelson Firestop Products: CMP Firestop Mortar.

E. Firestop Putty Stick: Intumescent, non-hardening, firestop putty for single or bundled cables and non-combustible pipe penetrations. For use in horizontal or vertical, concrete, masonry or gypsum wall assemblies.

1. 3M: MP + Stix.

2. Hilti: CP 618 and CP 619T.

3. Tremco: TREMstop MP Putty Stick.

4. Nelson Firestop Products: FSP AA445, AA439.

F. Firestop Putty Pad: Moldable firestop putty for protection of electrical outlet boxes.

1. 3M: MPP+.

2. Hilti: CP 617.

3. Tremco: TREMstop MP Putty Pad.

4. Nelson Firestop Products: FSP AA452, AA439..

G. Firestop Sealant: Smoke, gas and water resistant. For use in horizontal or vertical, concrete, masonry or gypsum wall assemblies.

1. Two or single component intumescent system for protection of combustible and non-combustible pipe, conduit and cable penetrations.

a) 3M: CP-25WB+, IC-15WB+, 3000WT.

b) Hilti: FS ONE.

c) Tremco: TREMstop IA+ or FyreCaulk.

d) Nelson Firestop Products: ES1399.

2. Silicone based system that provides maximum movement in fire-rated joint applications and pipe penetrations.

a) 3M: 2000+, 2000 NS.

b) Hilti: CP 601S.

c) Tremco: TREMstop Fyre-sil.

d) Nelson Firestop Products: CLK AA529, AA542, AA492.

3. Acrylic based system that provides movement capability in fire rated joints and seals through penetration applications.

a) 3M: FD 150+.

b) Hilti: CP 606.

c) Tremco: TREMstop Acrylic GG.

d) Nelson Firestop Products: FSC3.

4. Self-leveling silicone-based firestop sealant for use with through penetrations and construction floor joints.

a) 3M: 1000 SL.

b) Hilti: CP 604.

c) Tremco: TREMstop Fyre-sil S.L.

d) Nelson Firestop Products: CLK AA539, AA552.

H. Firestop Wrap Strip: Wrap strip of intumescent, flexible firestop for use with plastic and insulated pipe penetrations. For use in horizontal or vertical, concrete, masonry or gypsum wall assemblies.

1. 3M: Ultra GS, FS-195.

2. Hilti: CP 648-S, CP 648-E.

3. Tremco: TREMstop SuperStrip or TREMstop WS.

4. Nelson Firestop Products: MCT, MPS.

I. Spray: Sprayable or brush applied fire-rated mastic for construction joints where maximum movement is required. For use in horizontal or vertical, concrete, masonry or gypsum wall assemblies, at top of wall joints, curtain wall/slab edge and expansion joints.

1. 3M: FD 200.

2. Hilti: CP 672.

3. Tremco: TREMstop Acrylic SP spray.

4. Nelson Firestop Products: FSC3.

J. Metal Deck Strips and Plugs: Precut preformed mineral wool plugs and strips to fit flutes of metal deck profile and gap between top of wall and metal deck.

1. 3M: PM4.

2. Hilti: CP 777 Speed Plugs; CP 767 Speed Strips.

3. Tremco:

4. Nelson Firestop Products:

K. Fire Safing, Mineral Fiber or Ceramic Wool Non-Combustible Insulation:

1. Mineral Fiber: Density 4 pounds per cubic foot, USG Thermafiber, Fibrex "FBX Safing Insulation," or equal.

2. Ceramic Wool: Density 6 pounds per cubic foot, Johns Manville "Ceramic Fiber Insulation", Unifrax "Fiberfrax" ceramic fiber, or equal. Provide material in tested thickness for required hour rating.

a. Flame Spread: Less than or equal to 25.

b. Smoke developed: Less than or equal to 50.

3. For mineral fiber, provide 20 gage minimum size metal retainer clips and plates for fire safing support in vertical applications and in compliance with tested system design.

L. Supplemental Material: Provide supplementary materials required for complete, fire rated, installation.

2.03 SOURCE QUALITY CONTROL

A. Fire stop and smoke seal material shall be tested by an independent testing agency for conformance to Flame (F) and Temperature (T) requirements of ASTM E814/UL 1479.

B. Conform to UL Fire Hazard Classification Requirements. Material shall be classified as a fill, void, or cavity material and system for UL Through Penetration Firestop System.

C. Material shall be tested and shall display Flame Spread Index of 25 or less, and Smoke Developed Index of 450 or less when tested in accordance with ASTM E84.

PART 3 - EXECUTION

3.01 APPLICATION REQUIREMENTS

A. Provide single component fire stop sealant or putty:

1. Within penetrations subject to movement including conduit, cable bundles, buss duct, and noncombustible pipe.

2. As a sealant or caulking for smoke barrier construction, fire, and smoke dampers, mechanical/electrical framed elements in masonry and gypsum board partition systems, and other conditions.

B. Provide mineral fiber insulation for fire safing at joints and openings through floor slabs, walls, and partitions not indicated to be grouted, gaskets, sealed or otherwise made sound or air tight in this or other sections. Fire safing shall be packed and wedged solidly from both sides of walls and partitions, and from both top and bottom sides of slabs with noncombustible mineral fiber insulation.

3.02 PREPARATION

A. Examine the areas and conditions where fire stops and smoke seals are to be installed for conditions detrimental to the proper completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected for rated fire protection.

B. Surface to receive fire stops or smoke seals shall be free of dirt, dust, grease, form release agents, or other matter that would impair the bond of the fire stop material to the substrate or penetrating items. Substrate shall be frost free and when required, dry.

C. Voids and cracks in substrate shall be filled and unnecessary projections removed before installation of fire stops.

D. Penetrating items shall be permanently installed before fire stop and smoke seal installation.

E. Assure that all pipes, conduit, cable, and other items, which penetrate fire rated construction, have been permanently installed before installation of fire stops. Schedule and sequence the Work to assure that partitions and other construction, which would conceal penetrations, are not installed before the installation of fire stops and smoke seals.

F. Comply with manufacturer's recommendations for temperature and humidity conditions before, during, and after installation of fire stops and smoke seals.

3.03 INSTALLATION

A. General: Provide installation in accordance with manufacturer's installation procedures, as required. Install fire stops in accordance with fire test reports, UL Fire Resistance Directory, Intertek Testing Services Directory or SpecDirect, and reviewed Sample installations.

B. Dam Construction:

1. Install dams when required to properly contain fire stopping materials within openings and as required to achieve fire resistance rating as tested and rated.

2. Provide in conformance with installation requirements for type of floor, wall, and partition construction, and as recommended by fire stop manufacturer.

3. Combustible damming material shall be removed after appropriate curing. Noncombustible damming material may be left as a permanent component of the fire stop system.

4. Placement of dams shall not interfere with function, or adversely affect the appearance, of adjacent construction.

C. Installation of Single Component Fire Stop Sealant:

1. Provide noncombustible insulation as required to achieve fire resistance rating.

2. Install with manual or powered caulking gun. For up to 3 hour rating, install to the thickness required by the Listed System Designs as directed for wall and floor applications.

3. Surface of gun grade fire stop sealant shall be tooled with clean potable water.

4. Remove excess materials from adjacent surfaces within 10 minutes, with either water or other material compatible with sealant and recommended by sealant manufacturer, leaving the Work in a neat, clean condition.

D. Installation of Cementitious Fire Stop Mortar:

1. Mixing: Add dry powder to water and mix with mechanical mixer or hand mixing tools. Ratio and duration of mix shall be as instructed by fire stop mortar manufacturer. Average wet density of mortar shall be 70 pounds per cubic foot (+/- 5).

2. Wet surfaces before installation of fire stop mortar. Mortar may be hand installed or pumped into the opening.

3. When installing around layered and/or grouped cables, vibrate or move the cables slightly to prevent voids from forming between the cables.

4. Exposed surfaces shall be finished with conventional plastering tools before curing.

5. Allow at least 48 hours for initial cure before form removal. For full cure allow 27 days.

3.04 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Repair damaged areas and restore integrity of assembly.

C. Keep areas of work accessible until inspection by authorities having jurisdiction.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Clean surfaces adjacent to sealed openings and joints and remove excess of firestopping materials.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Joint sealants as indicated or required.

C. Related Sections:

1. Section 07 60 00: Flashing and Sheet Metal.

2. Section 07 84 00: Fire Stops and Smoke Seals.

3. Section 08 11 13: Hollow Metal Doors and Frames.

4. Section 08 41 13: Aluminum Windows

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating sealant joint locations, with full-size sealant joint details.

B. Product Data: Submit manufacturer's literature for each sealant material.

C. Material Samples: Submit Samples indicating color range available for each sealant material intended for installation in exposed locations.

D. Certifications: Submit manufacturer’s certification materials comply with requirements specified.

E. Site Samples: At locations required, provide a Sample of sealant for each typical installation, approximately 24" long, including joint preparation, backing, sealant and tooling. Allow backing to extend 6" beyond end of sealant for inspection of substrate.

F. Test Reports: Submit manufacturer's adhesion compatibility test reports according to ASTM C 794 for each substrate.

1.03 QUALITY ASSURANCE

A. Qualifications of Installer: The Work of this section shall be installed by a firm which has been in the business of installing similar materials for at least 5 consecutive years; and can show

evidence of satisfactory completion of 5 projects of similar size and scope. Installer shall have applicators trained and approved by manufacturer for performing this Work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store in accordance with manufacturer's recommendations. Provide a uniform ambient temperature between 60 and 80 degrees F.

1.05 WARRANTY

A. Manufacturer shall provide a 5 year material warranty.

B. Installer shall provide a 2 year labor warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. Furnish sealants meeting following in-service requirements:

1. Normal curing schedules are permitted.

2. Non-staining, color fastness (resistance to color change), and durability when subjected to intense actinic (ultraviolet) radiation are required.

B. Furnish the products of only one manufacturer unless otherwise required, sealant colors as selected to match the adjoining surfaces.

2.02 MATERIALS

A. Sealants:

1. Sealant 1: Acrylic latex, one-part, non-sag, mildew resistant acrylic emulsion compound complying with ASTM C 834, Type S, Grade NS, formulated to be paintable.

a. Tremco Inc., Acrylic Latex Caulk.

b. Bostik Construction Products Division, Chem-Calk 600.

c. Pecora Corporation, AC-20.

2. Sealant 2: Butyl sealant, one-part, non-sag solvent-release-curing sealant complying with FS TT-S-001657 for Type 1 and formulated with a minimum of 75 percent solids.

a. Tremco Inc., Tremco Butyl Sealant.

b. Bostik Construction Products Division, Chem-Calk 300.

c. Pecora Corp., BC-158.

3. Sealant 3: Silicone sealant, one-part non-acid-curing silicone sealant complying with ASTM C 920, Type S, Grade NS, Class 25.

    a. Dow Corning Corp., Dow Corning 790, 791, 795.

    b. General Electric Co., Silpruf.

    c. Tremco, Inc., Spectrem 1.

    d. Pecora Corp., 864.

4. Sealant 4: One-part mildew-resistant silicone sealant, complying with ASTM C 920, Type S, Grade NS, Class 25.

    a. Dow Corning Corp., Dow Corning 786.

    b. General Electric Co., Sanitary 1700.

    c. Tremco, Inc., Proglaze White.

    d. Pecora Corp. 863 White.

5. Sealant 5: One-part non-sag urethane sealant, complying with ASTM C 920, Type S, Grade NS, Class 25.

    a. Bostik Construction Products Div., Chem-Calk 900.

    b. Mameco International, Inc., Vulkem 116.

    c. Tremco, Inc., Dymonic.

    d. Sika Corporation, Sikaflex 1-A.

6. Sealant 6: Multi-part pouring urethane sealant, complying with ASTM C 920, Type M, Grade P, Class 25.

    a. Tremco, Inc., HPL.

    b. Mameco International, Inc., Vulkem 255.

    c. Sika Corporation, Sikaflex 2C NS/SL.

    d. W.R. Meadows, Pourthane.

7. Sealant 7: Acoustical sealant, non-drying, non-hardening permanently flexible conforming to ASTM D 217.

    a. Pecora Corp., BA-98 Acoustical Sealant.

    b. Tremco, Inc., Tremco Acoustical Sealant.

    c. United States Gypsum Co., Sheetrock Acoustical Sealant.

B. Penetrations Through Fire Barriers: Refer to Section 07 8400: Fire Stops and Smoke Seals.

1. 3M Brand Fire Barrier Calk CP-25.

2. 3M Brand Fire Barrier Putty 303.

C. Joint Backing: ASTM D 1056; round, closed cell Polyethylene Foam Rod; oversized 30 to 50 percent larger than joint width, reticulated polyolefin foam.

D. Primer: Non-Staining Type. Provide primer as required and shall be product of manufacturer of installed sealant.

E. Lacquer sealer shall be clear, as recommended by sealant manufacturer.

F. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer.

G. Sealants shall have normal curing schedules, shall be nonstaining, color fast and shall resist deterioration due to ultraviolet radiation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that joint openings are ready to receive Work and field tolerances are within the guidelines recommended by sealant manufacturer.

3.02 SURFACE PREPARATION

A. Joints and spaces to be sealed shall be completely cleaned of all dirt, dust, mortar, oil, and other foreign materials which might adversely affect caulking Work. Where necessary, degrease with an solvent or commercial degreasing agent. Surfaces shall be thoroughly dry before application of sealants.

B. If recommended by manufacturer, remove paint and other protective coatings from surfaces to be calked before priming and installation of sealants.

C. Preparation of surfaces to receive sealant shall conform to the sealant manufacturer's specifications. Provide air pressure or other methods to achieve required results. Provide masking tape to keep sealants off surfaces that will be exposed in finished Work.

D. Etch concrete or masonry surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5 percent solution of muriatic acid; neutralize with dilute ammonia solution, rinse thoroughly with water and allow to dry before sealant installation.

E. Perform preparation in accordance with ASTM C 804 for solvent release sealants, and ASTM C 962 for elastomeric sealants.

F. Protect elements surrounding Work of this section from damage or disfiguration.

3.03 SEALANT APPLICATION SCHEDULE

	Location	Type	Color
A.	Exterior & Interior joints in horizontal surfaces of concrete; between metal & concrete masonry and mortar.	Sealant 6	To match adjacent material
B.	Exterior door, entrance & window frames. Exterior & interior vertical joints in concrete & masonry metal flashing.	Sealant 3 or 5	To match adjacent material
C.	Joints within glazed curtain wall system. Skylight framing system. Aluminum entrance system glass and glazing.	Sealant 3	Translucent or Black
D.	Interior joints in ceramic tile and at plumbing fixtures.	Sealant 4	Translucent or White
E.	Under thresholds.	Sealant 2	Black
F.	All interior joints not otherwise scheduled	Sealant 1	To Match Adjacent Surfaces
G.	Heads and sills, perimeters of frames and other openings in insulated partitions	Sealant 7	Match Adjacent Surfaces

3.04 APPLICATION

A. Provide sealant around all openings in exterior walls, and any other locations indicated or required for structure weatherproofing and/or waterproofing.

B. Sealants shall be installed by experienced mechanics using specified materials and proper tools. Preparatory Work (cleaning, etc.) and installation of sealant shall be as specified and in accordance with manufacturer's printed instructions and recommendations.

C. Concrete, masonry, and other porous surfaces, and any other surfaces if recommended by manufacturer, shall be primed before installing sealants. Primer shall be installed with a brush that will reach all parts of joints to be filled with sealant.

D. Sealants shall be stored and installed at temperatures as recommended by manufacturer. Sealants shall not be installed when they become too jelled to be discharged in a continuous flow from gun. Modification of sealants by addition of liquids, solvents, or powders is not permitted.

E. Sealants shall be installed with guns furnished with proper size nozzles. Sufficient pressure shall be furnished to fill all voids and joints solid. In sealing around openings, include entire perimeter of each opening, unless indicated or specified otherwise. Where gun installation is impracticable, suitable hand tools shall be provided.

F. Sealed joints shall be neatly pointed on flush surfaces with beading tool, and internal corners with a special tool. Excess material shall be cleanly removed. Sealant, where exposed, shall be free of wrinkles and uniformly smooth. Sealing shall be complete before final coats of paint are installed.

G. Comply with sealant manufacturer's printed instructions except where more stringent requirements are indicated on Drawings or specified.

H. Partially fill joints with joint backing material, furnishing only compatible materials, until joint depth does not exceed 1/2 inch joint width. Minimum joint width for metal to metal joints shall be 1/4 inch. Joint depth, shall be not less than 1/4 inch and not greater than 1/2 inch.

I. Install sealant under sufficient pressure to completely fill voids. Finish exposed joints smooth, flush with surfaces or recessed as indicated. Install non-tracking sealant to concrete expansion joints subject to foot or vehicular traffic.

J. Where joint depth prevents installation of standard bond breaker backing rod, furnish non-adhering tape covering to prevent bonding of sealant to back of joint. Under no circumstances shall sealant depth exceed 1/2 inch maximum, unless specifically indicated on Drawings.

K. Prime porous surfaces after cleaning. Pack joints deeper than 3/4 inch with joint backing to within 3/4 inch of surface. Completely fill joints and spaces with gun applied compound, forming a neat, smooth bead.

3.05 MISCELLANEOUS WORK

A. Sealing shall be provided wherever required to prevent light leakage as well as moisture leakage. Refer to Drawings for condition and related parts of Work.

B. Install sealants to depths as indicated or, if not indicated, as recommended by sealant manufacturer but within following general limitations:

1. For joints in concrete walks, slab and paving subject to traffic, fill joints to a depth equal to 75 percent of joint width, but not more than 3/4 inch deep or less than 3/8 inch deep, depending on joint width.

2. For building joints, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.

3.06 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.07 CURING

A. Sealants shall cure in accordance with manufacturer's printed recommendations. Do not disturb seal until completely cured.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 08 11 13

HOLLOW METAL DOORS, WINDOWS AND FRAMES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Hollow metal doors and frames as indicated.

C. Related Sections:

1. Section 07 92 00: Joint Sealants.

2. Section 08 71 00: Door Hardware.

3. Section 08 80 00: Glazing.

4. Section 09 91 00: Painting and Coating.

1.02 SYSTEM DESCRIPTION

A. Design Requirements: Door-and-frame assemblies or frames shall include all reinforcing and provisions for hardware as shown and specified. Drawings indicate profile and general details of steel frame fabrication and installation, in addition to referenced details 1, 2, 3 and 3A in this section.

1.03 SUBMITTALS

A. Shop Drawings: Submit composite Shop Drawings indicating detailed relationships of installation including Work of adjacent construction, finish hardware, security, fire and life safety devices, glazing, caulking, and requirements for field installation. Include elevations of each hollow metal door type, details of each frame type, location schedule of doors and frames indicating same reference for details and openings as indicated on Drawings, conditions of openings of various wall sections and materials, typical and special details of construction, methods of assembling sections, location and installation requirements for hardware, material size, shape, and thickness, and all joints and connections.

B. Product Data: Submit manufacturer's Product Data indicating composition and construction for each fabricated item including louvers, coatings, finishes, and other components demonstrating compliance with referenced standards.

C. Certification: Submit certification of compliance with referenced standards and specified criteria, including but not limited to fire ratings in accordance with UL 10C, Physical Endurance in accordance with ANSI A250.4 and Prime Paint performance in accordance with ANSI A250.10.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum documented experience of more than five years in work of this section.

B. Installer Qualifications: Minimum documented experience of more than five years in work of this section

C. Coordinate with hardware supplier for fabrication of doors and frames to receive hardware items.

D. Coordinate with intrusion alarm supplier for fabrication of doors and frames to receive intrusion detection devices.

E. References: Work shall comply with physical and performance requirements of following standards, including all standards referenced in them, except for more stringent provisions specified herein or required by regulatory agencies:

1. ANSI/SDI A250.8 - 2003, SDI 100 Recommended Specifications for Standard Steel Doors and Fames.

2. ANSI/NFPA 252, Fire Tests of Door Assemblies.

3. ANSI/UL 10B, Fire Tests of Door Assemblies.

4. ANSI/UL 10C, Positive-Pressure Fire Tests of Door Assemblies.

5. ANSI/NFPA 80, Fire Doors and Fire Windows

6. HMMA, Guide Specifications for Commercial Hollow Metal Doors & Frames (Standard of National Association of Architectural Metal Manufacturers).

7. ANSI/SDI A250.4, Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frame Anchors and Hardware Reinforcings.

8. ANSI A250.10, Test Procedure and Acceptance Criteria for Prime Painted Steel Doors and Frames.

9. ANSI A250.6, Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.

F. Standards of Workmanship and Installation:

1. Finished Work shall be of uniform profile, accurately fabricated, rigid and strong, square and true, neat in appearance, smooth and free from dents, waves, warps, buckles, open joints, tool marks and/or other defects.

2. Steel sheet shall be clean with smooth surfaces free of scale, pitting or other defects.

3. Construction joints shall be flush, tight and welded their full length, ground flush and smooth on exposed surfaces.

4. All frame and door reinforcing and hardware provisions shall be performed in fabrication shop. Provide all cuts, welds, and other fabrications before galvanizing or shop priming.

5. Lines and molded members shall be straight and true with angles as sharp as practical for thickness involved, surfaces flat, and fastenings concealed.

1.05 DELIVERY, STORAGE AND HANDLING

A. Frames: Before shipment, install temporary spreaders at bottom of bucks and do not remove until frames are installed.

B. Doors: Provide protection as required to protect doors during shipping and storage. Damaged doors will be rejected.

C. Inspect hollow metal Work upon delivery for damage. Remove and replace damaged items with new Work as required.

D. Store doors and frames in an upright position at Project Site under cover and protected from weather-related elements. Store units on minimum 4" high wood blocking with ½" air spaces between stacked doors to provide circulation. Do not store doors and frames under plastic or canvas shelters that can create a humidity chamber. If shipping packaging becomes wet, immediately remove packaging.

1.06 WARRANTY

A. Manufacturer shall provide a 1 year material and workmanship warranty.

B. Installer shall provide a 2 year labor warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. All doors and frames shall be products of a single manufacturer.

B. The following are acceptable manufacturers, as are others that can demonstrate their products are equivalent in quality, performance and compliance with these specifications.

1. Security Metal Products Corp.

2. Curries Manufacturing, Inc.

3. Steelcraft.

4. Amweld Metal Doors and Frames.

5. Stiles Custom Metal, Inc.

6. Door Components Inc.

7. CECO Door.

C. All materials, fabrication and installation must comply with requirements of standards referenced in Section 1.04, Quality Assurance.

2.02 MATERIALS

A. Steel

1. Exterior Doors and Frames: Galvanized Carbon Sheet Steel, Commercial Quality, A60 zinc coating (0.30 ounces per square foot per side), ASTM A653.

2. Interior Doors and Frames: Cold-Rolled Steel Sheets, Commercial Quality Carbon Steel, ASTM A1008.

3. Steel shall be free of scale, pitting, coil breaks or other surface blemishes, and free of buckles, waves or other defects.

4. Steel thicknesses expressed in steel gages (MSG) is for reference only. Actual steel thicknesses must meet minimum requirements of ASTM standards and as described in ANSI/SDI A250.8.

B. Sound Deadening Core Insulation: Furnish rigid, unsettling, vermin-proof, and non-combustible fiberglass or rockwool type material to provide required STC and thermal ratings within door fabrications. Doors shall have a minimum sound transmission classification of 28 as tested under ASTM E90 and ASTM E413 unless noted otherwise.

C. Supports and Anchors: Fabricate from a minimum 16 gauge galvanized sheet steel unless noted otherwise.

D. Fasteners: Provide as shown on Drawings and to suit conditions of secure installations. Furnish 304 Grade stainless steel types at exterior doors.

E. Door Louvers:

1. Louver free air flow shall be 50% free area.

2. Louvers for exterior doors shall be galvanized and furnished with not less than 12 gage frame and security grille welded to 18 gage steel blades, fully galvanized, with removable galvanized or bronze insect screen on inside. Install louver with tamperproof-head through-bolts. Anemostat PLSL, Air Louvers Inc. Model 1500-A or equal.

3. Fusible link louvers: Listed by State Fire Marshal, UL labeled and installed with tamperproof fasteners.

4. Lightproof louvers (at dark rooms): DRDL by Anemostat, Air Louver Model 1000, or equal.

5. All louvers shall be furnished with factory primer.

F. Vision panels: Manufacturer's standard, U.L. approved, finished flush with door face, with no visible fasteners on either door face.

G. Shop Paint:

1. Conform to Steel Structures Painting Council (SSPC) for all steel components.

2. Pretreatment/priming coatings shall be compatible with Project site finish painting system in accordance with Section 09900.

3. At frames to be grouted, all surfaces that are inaccessible after installation shall be coated with bituminous or asphaltic base paint.

2.03 FABRICATION GENERAL

A. General: Fabricate hollow metal units to be rigid, neat in appearance, and free from defects including warp or buckle.

1. Accurately form metal to required sizes and profiles. Fit and assemble all units in manufacturer's plant. Where practical, factory or shop fit and assemble units for shipment.

2. Weld all joints continuously; grind, dress, and make smooth, flush, and invisible. Filler to conceal manufacturing defects or damage is not permitted.

3. Corner Joints: Finish corner joints by mitering, or coping and butting, or a combination of both. Trim and backbend shall be continuous around corner.

4. Continuously weld joints for full depth and width of frame, trim, and backbends.

5. Clearances for Fire-Rated Doors: As required by NFPA 80.

2.04 FRAMES

A. General: Provide fully welded steel frames with integral stops and trim for doors, transoms, sidelights, borrowed lights, and other openings, and with details indicated for type and profile. Use concealed fastenings, unless otherwise indicated.

B. Metal Thickness of Frames (minimum):

1.	Interior hollow metal frames up to 4'-0" wide	16 gage
2.	Interior hollow metal frames wider than 4'-0"	14 gage
3.	Exterior hollow metal frames	14 gage
4.	Borrowed lights up to 4'-0" wide	16 gage

C. Supports and Anchors: Fabricate from at least 16-gage, galvanized steel sheet. Frame anchors shall comply with fire rated label requirements of opening.

1. Floor Anchors:

a. Minimum thickness: 12 gage galvanized steel sheet or bent steel plate, securely fastened inside each jamb, with two holes in anchor at each jamb for 3/8" floor anchorage fasteners. For preframed wood stud walls provide and additional wood stud anchor located as close to the bottom of the jamb as is practical.

b. Where required at sloping and uneven floor conditions, or to coordinate adjustments for trim alignments, provide adjustable floor anchors, providing at least 2" height adjustments.

2. Jamb Anchors:

a. Locate anchors near top and bottom and at intermediate points not to exceed 24 inches on center. Provide 2 anchors per head for openings up to 48 inches wide; over 48 inches wide provide anchors at 24 inches on center maximum.

b. Anchors in masonry construction: Provide manufacturers standard jamb anchors. Steel wire complying with ASTM A510, 0.177 inch in diameter, may be furnished.

c. Anchors in Stud Partitions: Provide steel anchors, 16 gauge minimum sheet steel, of design to suit partition construction, securely welded inside each jamb.

d. Through-Frame Anchors: At frames indicated to be anchored with bolts through frame, provide countersunk holes for bolts with 16 gauge minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.

D. Inserts, Bolts, and Fasteners: Provide manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A153 Class C or D as required.

E. Head Reinforcing: Refer to Detail #2 of this section. Reinforcing shall not act as lintel or load-carrying member and shall comply with fire rating requirements. Provide at all frames regardless of whether or not closer is called for.

F. Hardware Reinforcement and Accessories:

1. Butt Hinge: 7 gage minimum.

2. Continuous hinge: 14 gage continuous strip reinforcing.

3. Head assemblies: Reinforced internally with, full length, 10 gage angles on each side of frame and bar at bottom of stop for closer reinforcement in all frames as shown in Detail #2 of this section.

4. Reinforcing for other items of finish hardware shall be accomplished according to ANSI A250.6.

5. Plaster Guards: Provide 26 gage galvanized steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

G. Mullion and Transom bars: Furnished and fabricated as specified for frames.

H. Glazed Openings: Applied stops with mitered or butted corners, of minimum 18 gage galvanized steel, one-piece lengths, secured within 3” of ends and at 12” centers with oval head countersunk tamper resistant screws. Corner joints shall be furnished with contact edges closed tight, with trim faces mitered and continuously welded. Frames for multiple openings shall be provided with mullion and/or rail members, fabricated of closed tubular shapes with no visible seams or joints. All joints between faces of abutting members shall be securely welded and finished smooth. Provide condensate weeps 4 inches on centers, maximum.

I. Door Silencers: Except for exterior doors, drill and punch frames for three silencers at lock jamb of single swing doors or in double doors with astragal and one silencer per leaf in heads of doubled door frames.

J. Where frames are installed in walls sitting on a concrete curb, provide a closure plate or extend backbends to provide closure where frame abuts concrete curb.

2.05 DOORS

A. General: Custom-made, flush-panel “seamless type” with one-piece face panels; continuous weld, seamless edge construction with no visible seams or joints on faces or on vertical edges.

1. Provide type and size of doors shown with louvers and openings for glazing where indicated.

2. Minimum Door thickness: 1 ¾ inches.

3. Face Sheet Minimum Gage: 16 gage.

4. Stiffeners: Stiffen door face sheets with continuous vertical-formed steel (rib) sections or back to back hat sections, minimum 20 gage, full thickness of interior space between door faces, spaced 6” on center maximum, and spot welded to both faces 4” on center maximum.

5. Core Insulation: Provide sound deadening and insulating material through entire core of door (full height, width, and thickness of door). Provide STC ratings where indicated on Drawings, scheduled, or for partition ratings indicated on Drawings.

    a. Doors, shall have a minimum sound transmission classification of 28 as tested under ASTM E90 and ASTM E413, unless noted otherwise..

    b. Exterior doors shall meet or exceed required thermal rating indicated on Drawings, scheduled, or for wall rating.

6. Door Edges: Join door face sheets at vertical edges of door with continuous weld full height of door. Grind, fill, and dress welds smooth to provide invisible seam with smooth, flush surface.

    a. Close ends of doors with continuous recessed channels, 16 gage steel minimum, spot welded to both face sheets. Close top and bottom edges of doors with a internal steel channel, screw attached into top and bottom of door. Channel shall be galvanized at exterior doors. No screws are allowed on visible faces of door. Provide openings in bottom closure of exterior doors to permit escape of entrapped moisture.

    b. Profile of Door Edges:

        1.) Single-acting swing doors: Bevel both vertical edges 1/8” in 2”.

        2). Pairs of single-acting swing doors: Bevel hinge edge 1/8” in 2”. Provide surface mounted astragals for labeled or unlabeled doors unless otherwise shown on Drawings or required.

        3). Double-acting swing doors: Round both vertical edges on 2” minimum radius.

7. Door Louvers: Install according to manufacturers recommendations.

8. Glass Stops:

    a. Furnish fixed stops integral with and welded at security side of door.

    b. Finish: Factory primer.

9. Transom: Fabricate to requirements specified for flush doors.

10. Labeled Doors: Where fire-rated openings and conditions are indicated.

a. Labeled doors shall be provided with fire-resistance rating indicated and shall be constructed as tested and approved by Underwriters' Laboratories (U.L) for installation in labeled frame and door assemblies.

b. Gaskets: Gaskets are supplied under Section 08 7100 Door Hardware. Gaskets and installation shall conform to requirements of NFPA 105, "Installation of Smoke and Draft Control Door Assemblies."

c. Fabricate labeled doors with same finished appearance as specified for non-labeled hollow metal doors; with welded door edges, filled and ground smooth; with label affixed to door.

d. Where fire labels are required and continuous hinge is specified, install label on top of door within 6" of hinge side of door.

K. Hardware Reinforcement and Accessories:

1. Provide sheet steel or plate reinforcement for finish hardware items wherever necessary. Mortise, drill and tap to template requirements for mortise type hardware.

2. Butt reinforcing: 7 gage minimum, of length 4" longer than length of butt. Minimum 3 spot welds at top and bottom.

3. Door closer reinforcement: 14 gage minimum steel channel, 6" high on each side of door.,. Reinforcement to extend full width of door in accordance with Detail #1 of this section.

4. Other Hardware Requirements: Cut, reinforce, drill, and tap doors and frames for other hardware, including energy management switches or contacts and security devices, in accordance with furnished hardware templates for accessory items. Thickness and size of reinforcement shall be as required by ANSI A250.6.

2.06 SHOP PRIMING

A. All exposed and concealed metal surfaces of all hollow metal doors, frames and other hollow metal Work of this Section shall be bonderized and then shop primed.

B. Exposed surfaces of doors, frames and accessories shall be filled, sanded smooth and cleaned before painting.

C. All exposed surfaces shall be shop primed after assembly.

PART 3 - EXECUTION

3.01 FRAME INSTALLATION

A. Install steel frames accurately in location, perfect alignment, plumb, straight and true. Brace frames to prevent displacement.

B. Anchor frames in concrete and concrete unit masonry with galvanized anchor bolts; 3/8 inch diameter, counter-sunk at 24 inches on center at head and jamb unless noted otherwise.

C. Anchor frames in steel frame partitions with manufacturer recommended anchors.

D. Install frame at fire rated openings in accordance with NFPA Standard No. 80.

E. Furnish filler for anchor attachment screws, and sand smooth.

3.02 DOOR INSTALLATION

A. Install steel doors in accordance with manufacturer's instructions and as indicated on Drawings and in Finish Hardware Specifications. Coordinate with Work of other trades.

B. Ensure that all door and jamb clearances comply with requirements of ANSI/NFPA 80.

C. Adjust operable parts for correct function.

D. Remove hardware, except primer-coated items, tag, box and install after finish painting has been completed.

3.03 PRIME COAT TOUCH-UP

A. Immediately after installation, remove rust, repair damaged surfaces to new condition, sand smooth, and install touch-up primer.

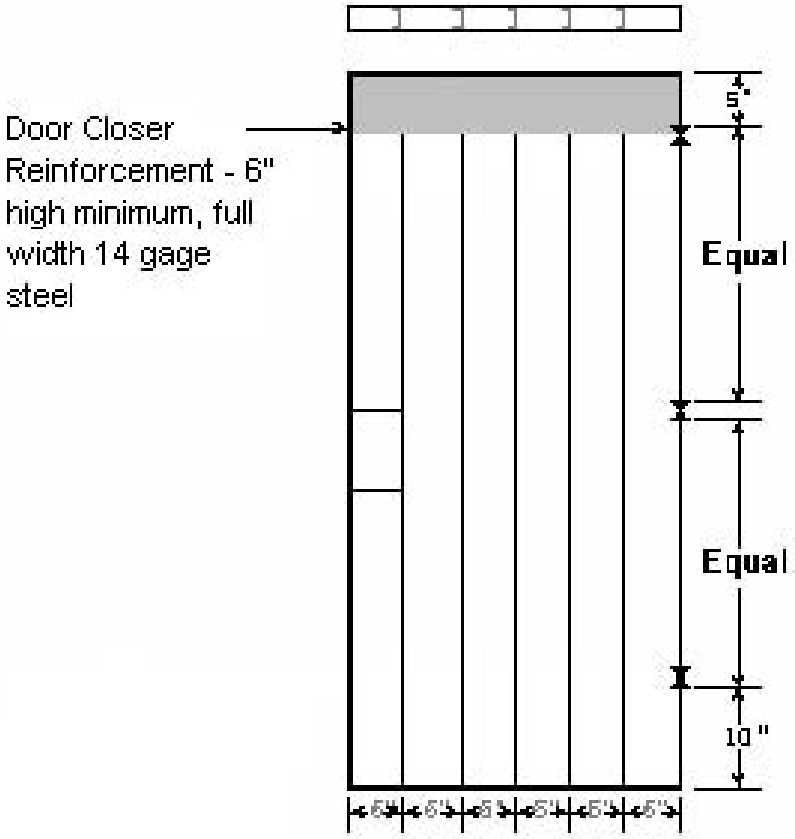
3.04 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off Project site.

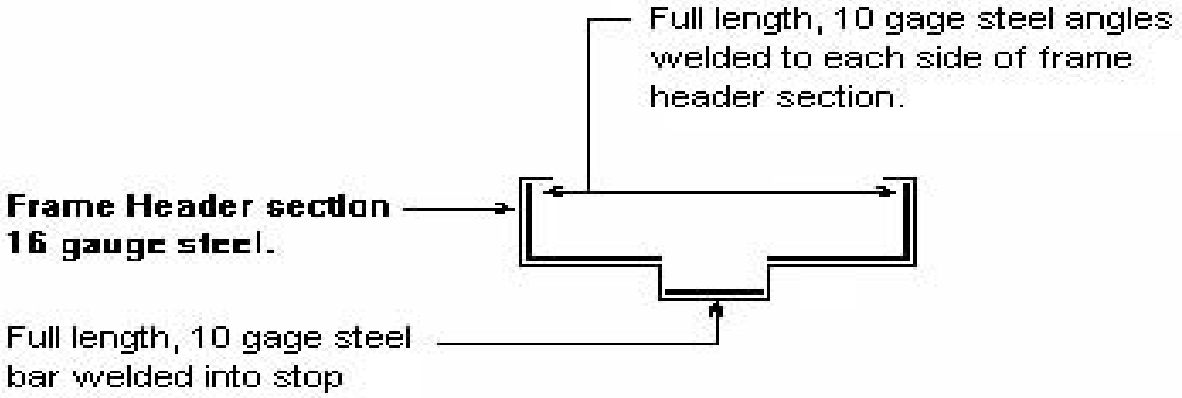
3.05 PROTECTION

A. Protect Work of this section until Substantial Completion.

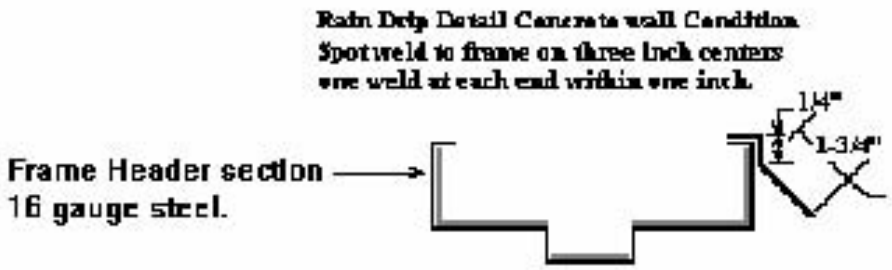
Detail # 1 - Door Hardware Reinforcement



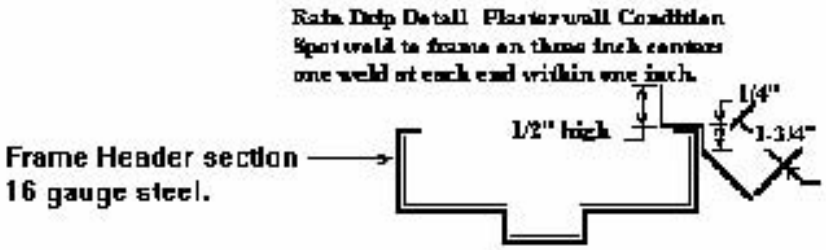
Detail # 2 – Frame Header Reinforcement
Door Closer reinforcement for all steel door frames.



Detail # 3 - Concrete Wall Condition Rain Drip
Detail fro Exterior Door where Rain Drip Required
Exterior Side with rain drip welded in place.



Detail # 3A
Plaster Wall Condition -
Detail for Exterior doors where rain drip is required.
Exterior side with rain drip welded in place.



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SECTION 08 33 23

OVERHEAD COILING DOORS AND GRILLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Overhead coiling doors as indicated.

B. Related Requirements:

1. Section 08 7100 - Door Hardware.

2. Section 09 9000- Painting and Coating.

3. Division 26 - Electrical.

1.02 DESIGN REQUIREMENTS

A. Drawings indicate sizes, locations, profiles, and general details of overhead coiling door and grille construction and installation.

B. Performance Requirements:

1. Wind load: Design, engineer and fabricate doors to withstand at least twenty pounds per square foot wind load.

2. Operation-cycle requirements: Design coiling doors components to a standard minimum of 25 cycles per day and a minimum of 50,000 operating cycles for the life of the door.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, rough-in diagrams, installation instruction and manufacturer's data. Submit manufacturer's data on locking devices, which are included in this Work.

B. Shop Drawings: Indicate materials, anchorage, and installation details. Indicate details and location of vehicle sensors in pavement. Indicate concrete curb installation of pass card receiver.

C. Closeout Submittals: Operation and Maintenance Data.

1.04 REGULATORY REQUIREMENTS

A. Fire rated coiling doors shall bear a label of UL, Warnock Hersey, FMG or other nationally recognized testing laboratory for the fire ratings listed on the drawings, and shall be approved for use by the California State Fire Marshall and DSA.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide protection as required by manufacturer to protect products from damage during shipping and storage.

1.06 WARRANTY

A. Provide manufacturer's two year warranty against defects in materials, fabrication, and installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide overhead coiling doors complete with guides, hoods, operating mechanism, and special features and control systems. Doors shall be as manufactured by Overhead Door Co., 600 Series or The Cookson Company, Inc., Cornell Iron Works, Inc., Lawrence Roll-Up Doors, Inc., or equal.

2.02 OVERHEAD COILING DOORS

A. Curtain: Constructed of interconnected strip steel slats conforming to ASTM A653.

1. Slats: At least 20 gage, strip steel, flat-faced section, 5/8 inch minimum deep. Fit alternate slats with end locks and where required by wind loads, furnish wind locks.

2. Insulated Doors: Slats shall be 3-inch high by 7/8 inch deep consisting of 22 gage interior and exterior slats separated by 13/16 inch insulation.

B. Bottom Bar: Shall consist of two galvanized ASTM A123 steel angles placed back to back and mechanically joined together, with vinyl or neoprene closure strip.

C. Barrel: Furnished curtain shall be coiled on a steel tube or pipe of size sufficient to carry door load with a deflection not to exceed .03 inch per foot of opening width. Curtain weight shall be evenly balanced by helical torsion springs. Spring tension shall be adjustable by means of an adjusting wheel accessible from outside. Finish steel tube with one coat of rust-inhibiting prime paint.

D. Brackets: 3/16 inch thick minimum, steel plate designed to house ends of door coils.

E. Hood: Galvanized sheet steel, 24 gage, contoured to fit brackets and reinforced to prevent sag. Furnish to field obtained dimensions.

F. Guides: Fabricate of 3/16 inch minimum structural steel shaped to form a slot of sufficient depth to retain curtain under normal wind load. Where wind locks are required, guides shall be provided with wind lock bars.

G. Gears: High grade cast iron with teeth cast from machine cut patterns. Gear ratio shall be designed for a maximum manual effort of 30 to 35 pounds to operate door.

H. Weatherstripping: Exterior doors shall be fully weatherstripped with replaceable weather seals at bottom bar and guides, and at hood with a weather baffle.

I. Finish: Curtain and hood:

1. Hot dipped galvanized ASTM A123.

2. Bonderized coating for prime coat adhesion.

3. Baked-on corrosion inhibiting primer and topcoat.

4. Bottom bar, guides and brackets shall have a factory spray applied rust inhibiting primer finish.

5. Color shall be as selected by Architect from manufacturer's standard range of colors.

J. Operation: Unless otherwise indicated, doors shall be electrically operated.

1. Doors shall be furnished with provision for padlocking from the inside.

2.03 ELECTRICALLY OPERATED OVERHEAD COILING DOORS

A. Door Fabrication: Same as specified for overhead coiling doors.

1. Provide electric sensing/weather edge seal installed along width of door bottom bar meeting UL 325 requirements. When activated Automatic sensing switch will prevent door from closing, so door will return to the completely open position.

B. Motor Operation: Motor shall be high starting torque, with sufficient power to operate door at an approximate average speed of 2/3 foot per second. Unit shall be controlled by an adjustable screw-type limit switch, which will break the circuit at termination of travel. High efficiency in line gear drive shall be furnished, together with a spring-set solenoid-operated brake completely housed to protect against damage, dust and moisture. An emergency hand chain operator, which does not affect the timing of the limit switch, shall be provided to operate the door in case of power failure or removal of motor for inspection or servicing. Operator shall be designed to transmit motion to the door through an adequately size roller chain and sprocket reduction system. An efficient overload protection device, which will break the control circuit and protect against damage to motor windings, shall be installed integral with the unit.

1. The unit shall be furnished with an interlocked reversing contactor, and operating components preconnected to a terminal strip within the control box to facilitate field connection to power source and control system.

2. The size of the motor shall be determined by the manufacturer to meet the design criteria. Motor rating shall be 208 volts, three phase, 60 Hz.

3. System shall be designed to operate for at least 100,000 cycles.

C. Control System:

1. The system shall be activated by a card key placed into a card reader. Sensor loops shall be installed for entry and exit at the overhead coiling door to prevent closing when a obstacle is present. Provide electric sensing/weather edge seal installed along width of door bottom bar meeting UL 325 requirements. When activated Automatic sensing switch will prevent door from closing, so door will return to the completely open position.

2. When door is on its downward cycle, the system shall provide the capability, upon activation of a sensor, to interrupt the downward cycle and open the door.

3. Provide a keyed bypass switch to override the sensor system and test the door operation. Lock shall be keyed to building keying system.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be by an authorized installer of coiling overhead door manufacturer.

B. Install curtains and operating equipment plumb, in true alignment, free of springing, forcing, racking or distortion.

C. Provide necessary hardware, anchors, inserts, hanger and equipment supports in accordance with manufacturer's literature, as indicated.

D. Fasten curtain guide assembly to adjacent members with galvanized fasteners at 24 inches on center for a rigid installation of curtain and operating equipment.

E. Upon completion of installation, lubricate, test and adjust rolling doors to operate easily, free from warp, twist or distortion and fitting properly around entire perimeter.

3.02 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 08 41 13

ALUMINUM FRAMED STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Aluminum windows, doors, and frames as indicated.

C. Related Sections:

1. Section 07 92 00: Joint Sealants.

2. Section 08 71 00: Door Hardware.

3. Section 08 80 00: Glazing.

1.02 SYSTEM DESCRIPTION

A. Design Requirements: Drawings indicate locations, sizes, profiles and general details of aluminum windows, door and frame construction and installation.

B. Performance Requirements: Comply with the following as a minimum requirement:

1. Air Infiltration: When system is tested according to NAAMM TM-1-68T, Section 4.3, air infiltration at perimeter of operating doors shall not exceed 0.25 cubic feet per minute per foot of sash perimeter, with air infiltration from other sources, including fixed doors and windows, not exceeding 0.06 cubic feet per minute per square foot of wall area, except the more restrictive requirements of governing laws and codes shall determine the maximum allowable infiltration. In computing wall area, areas of operating doors is not included.

C. Regulatory Requirements: Comply with CBC requirements.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings for the Work of this section, prepared and reviewed before fabrication. Include plans, elevations, opening, identification symbols, sizes, and complete details for materials, finishes, sizes, profiles, moldings, dimensioned locations of hardware items with reinforcement, methods of anchoring, assembly, installation, isolation, glazing procedure as well as reglazing procedures, materials, and caulking.

B. Product Data: Submit manufacturer’s Product Data.

C. Material Samples: Submit the following:

1. Window, door and frame sections with specified finish, fasteners and accessories.

2. Cured sealant colors.

D. Calculations: Provide structural calculations, signed and sealed by a structural engineer licensed in the State of California, indicating that materials furnished for installation conform to requirements specified.

E. Deferred Approval by Division of the State Architect:

1. Submit to the OWNER a complete set of drawings, calculations and specifications for approval by the Division of the State Architect (DSA).

2. Documents must be signed by an engineer licensed in the State of California.

3. Allow six months in the schedule for DSA review.

4. Respond to DSA comments and resubmit until final approval is received.

1.04 QUALITY ASSURANCE

A. Quality Standards: Provide aluminum Work so that glass installation conforms to ANSI Z97, as applicable.

1.05 WARRANTY

A. Manufacturer shall provide a 20 year material warranty for aluminum storefront.

B. Manufacturer shall provide a 10 year material warranty for doors.

PART 2 - PRODUCTS

2.01 Materials:

A. Extrusions shall be 6063-T5 alloy and temper, ASTM B 221 alloy G.S. IDA-T5. Fasteners, where exposed, shall be aluminum, stainless steel, or zinc-plated steel in accordance with ASTM B 663. Perimeter anchors shall be aluminum or steel. Steel anchors shall be isolated from the aluminum as required.

1. Major portions of door sections, except glazing beads, shall be nominal 0.125 inch.

2. Wall thickness of frame members shall be nominal 0.093 inch.

B. Glazing gaskets shall be EPDM elastomeric extrusions or vinyl reinforced with fiberglass cord.

C. Door stiles and rails shall be tubular sections, accurately joined at corners with heavy concealed reinforcement brackets secured with bolts and screws, and shall be MIG- welded. Doors shall be furnished with snap-in stops with bulb glazing gasket both sides of glass. Exposed screws are not permitted. Each door leaf shall be furnished with an adjusting mechanism, located in the top rail near the lock stile, which provides for minor clearance adjustments after installation. A hard-backed poly-pile weatherstrip shall be installed in both stiles of center hung single doors.

D. Hardware: Finish hardware shall be as specified in Section 08 71 00: Door Hardware.

2.02 FINISH

A. Windows and accessories shall be furnished with an organic finish applied over a five-stage aluminum pre-treatment. Finish shall be a two-coat PVDF fluorocarbon coating system with a minimum of 1.2 mil thickness and conforming to AAMA 2605.

2.03 MANUFACTURERS

A. Framing system shall be as manufactured by Arcadia, RPS Architectural Systems or Kawneer. Framing sections shall be 2-1/4 inches x 6 inches off-set Glazing System x 1 inch glazing.

B. Basis of Design: Arcadia, TC670 Series system with monolithic glazing for storefronts.

2.04 FABRICATION

A. The framing system shall provide continuous head and sill channels spliced together with formed brake metal sleeves at center of vertical mullions. The framing system shall provide for flush glazing on sides with no projecting stops. Vertical and horizontal framing members shall have a nominal face dimension and overall depth shall be as noted above. Door framing members shall match glass framing appearance.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Glass framing shall be installed in correct locations as indicated in the details and shall be level, square, plumb and in alignment with other members. Joints between framing and the building structure shall be sealed as required.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 08 63 23

METAL-FRAMED SKYLIGHTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metal-Framed Skylights.

2. Glass and glazing for skylights.

3. Flashings and gutter liners.

B. Related Requirements:

1. Division 01 - General Requirement.

2. Section 09 22 16 - Metal Support Assemblies.

3. Section 07 60 00 - Flashing and Sheet Metal.

4. Section 07 92 00 - Joint Sealants.

5. Section 12 24 13 – Roller Window Shades.

6. Division 26 – Electrical.

1.02 SECTION DEFINITIONS

A. Water leakage is defined as any uncontrolled water that appears on any exposed interior surface that is not drained back to the exterior.

1.03 DESIGN REQUIREMENTS

A. Drawings indicate sizes, locations, profiles, and general details of skylight construction and installation.

B. The total deflection of support members less than 20 feet in length shall not exceed 1/75 of that length or one inch, whichever is smaller, at design loading. Support members 20 feet or greater shall not exceed 1/240.

C. The deflection of a framing member in a direction parallel to the plane of the glass, when carrying its full load, shall not reduce the glass or panel bite below 75 percent of the design dimension.

D. Framing members and the edge of glazing products shall have a 1/8 inch minimum clearance at maximum deflection.

E. Deflections shall not impair the function of or damage joint seals or glazing.

F. Vault rafter segments shall be moment connections. The skylight shall impose no lateral loads on the supporting structure other than wind and seismic loads.

G. Glass Performance Requirements:

1. Probability of breakage shall not exceed 1/1000 for sloped glass upon imposition of design wind and live loads for one minute.

2. Probability of breakage due to anticipated thermal stress not to exceed 1/1000.

3. Comply with CBC requirements.

1.04 SUBMITTALS

A. Shop Drawings: Submit plans, elevations, details and calculations.

B. Material Samples:

1. Submit finish Samples for aluminum materials and flashings.

2. Submit glass Samples, minimum 6-inch by 6-inch.

C. Certificates:

1. Submit notarized statement certifying that the stress on the silicone sealant, when exposed to the specified wind load does not exceed 20 psi for a 6-to-1 safety factor.

2. Submit compatibility statement that the materials in contact with the sealant, such as gaskets, spacers, and setting blocks, are compatible with the sealant after 21 days exposure to ultra-violet, 200-4000 micro watt ultraviolet radiation.

D. Calculations: Submit structural calculations prepared, signed, and sealed by a structural engineer licensed in the State of California.

E. Test Reports:

1. The skylight manufacturer shall submit for review at least three test reports by a nationally recognized testing facility indicating that similar skylight products by the manufacturer have been tested according to the referenced standards and that the skylight passed those tests.

2. Test data on adhesion to production samples of metal and glass, tested in accordance with ASTM C794.

1.05 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:

1. AAMA 501.1 - Standard Test Method for Metal Curtain Walls for Water Penetration Using Dynamic Pressure.

2. AAMA 501.2 - Field Check of Metal Curtain Walls for Leakage.

3. AAMA 501.3 - Field Check of Water Penetration Through Installed Exterior Windows, Curtain Walls, and Doors by Uniform Air Pressure Difference.

4. AAMA 603.8 - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.

5. AAMA 2605 - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.

6. AAMA 606.1 - Voluntary Guide Specification and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.

7. ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

8. ASTM A193 - Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service.

9. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

10. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.

11. ASTM B211 - Aluminum and Aluminum-Alloy Bar, Rod and Wire.

12. ASTM B221 - Aluminum-Alloy Extruded Bars, Rods, Wires, Profiles and Tubes.

13. ASTM B316 - Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heating Wire and Rods.

14. ASTM C719 - Adhesion and Cohesion of Elastomeric Joint Sealants under Cyclic Movement (Hockman Cycle).

15. ASTM C794 - Adhesion-in-Peel of Elastomeric Joint Sealants.

16. ASTM C1036 - Flat Glass.

17. ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

18. ASTM D395 - Rubber Property - Compression Set.

19. ASTM D412 - Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

20. ASTM D1171 - Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).

21. ASTM D2240 - Rubber Property - Durometer Hardness.

22. ASTM E283 - Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

23. ASTM E330 - Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

24. ASTM E331 - Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

25. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

26. ASTM E783 - Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

27. GANA - Glazing Manual.

28. US CPSC Standard 16 CFR 1202 - Architectural Glazing Standards and Related Material.

B. Qualifications of Installer: Minimum 10 years experience installing work of similar scope and complexity.

1.06 WARRANTY

A. Manufacturer shall provide a ten year material warranty.

B. Installer shall provide a five year fabrication and installation warranty.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Provide products and systems manufactured by Wasco Skymax, Model GSM 5296, or equal.

2.02 MATERIALS

A. Framework:

1. Supporting members shall be of extruded aluminum alloy 6063-T5 or 6061-T6 complying with ASTM B221.

2. Exterior caps shall be of extruded aluminum alloy 6063-T5 complying with ASTM B221.

3. Principal formed metal members shall be of aluminum alloy 5052 or 6061-T6 complying with ASTM B209.

B. Glazing: 1-1/16” insulating glass Solarban 70XL (#2 3/8” Argon/ 7/16” clear HS Laminated) dual panel, sandwich system.

C. Glazing Strips:

1. Extruded glazing strips shall be Type 1, heat cured silicone rubber designed to prevent adhesion, and complying with the following:

a. Hardness: ASTM D2240 Type A 50 +5 Durometer.

b. Tensile Strength: ASTM D412 800 psi minimum.

c. Elongation: 300 percent minimum.

d. Tear, die B, psi: 65 minimum.

e. Color: As selected by the Architect.

2. Compression Set: ASTM D395, 70 hours at 212 degrees F.: 20 percent maximum.

3. Heat Aging Characteristics:

a. Seventy hours at 212 degrees F.

b. ASTM D2240 hardness change: +3 Durometer.

c. ASTM D412 tensile change: -10 percent.

d. ASTM D412 elongation change: -20 percent.

4. ASTM D1171 weather-resistance, one part ozone per million, 500 hours at 20 percent elongation to show no cracks.

5. This material shall have no visual checks, cracks or breaks after completion of tests.

D. Setting Blocks: Extruded setting blocks shall be Type II silicone rubber designed to permit adhesion and complying with the following:

1. Hardness: ASTM D2240 Type A 80 + 5 Durometer.

2. Color: Black.

E. Fasteners:

1. Exterior cap retainers: ASTM A193 B8 300 series stainless steel.

2. Framework connections: ASTM B211 2024-T4 aluminum, ASTM A193 B8 300 stainless steel, and ASTM B316 aluminum rivets as required.

3. Anchoring to support structure: ASTM A 307 zinc-plated steel fasteners.

F. Flashing: Flashing shall be preformed 20 gage 5005-H4 aluminum, finished to match the skylight rafter caps.

G. Finishes: Coat aluminum components with a PVDF coating system, conforming to AAMA 2605. Color as selected by Architect, from manufacturer's standard colors.

H. Sealants:

1. Structural joints and non-structural seals shall be high performance silicone sealants installed in accordance with the manufacturer's written recommendations.

2. Structural Sealant Performance Requirements:

a. Hardness: ASTM D2240 Type A, 30 Durometer.

b. Ultimate tensile strength: ASTM D412, 170 psi.

c. Tensile strength at 150 percent elongation: ASTM D412; minimum 80 psi.

d. Joint movement capability after 14 day cure: ASTM C719, +50 percent.

e. Peel strength (aluminum, glass concrete) after 21 day cure: ASTM C794, 32 pounds per inch.

3. Structural silicone shall not support dead weight of vertical glass or panel.

2.03 SHOP FABRICATION

A. Fitting and assembly shall be performed in the manufacturer’s facilities. Work, which cannot be assembled in the manufacturer’s facilities as a complete system, shall be completely assembled, marked, and disassembled before shipment to the Project site.

PART 3 - EXECUTION

3.01 FABRICATION

A. The skylights shall be fabricated with extruded aluminum members of alloys as specified.

B. Rafter bars shall be of one piece construction.

C. Rafter bars shall be designed for snap-in type glazing strips.

D. Clips for the attachment of rafter bars shall be aluminum and shall be shop riveted, bolted, or welded to rafter bars.

E. Welding shall be performed by the heliarc process. Exposed welds shall be ground flush and smooth.

F. Waterproofing shall be furnished by means of continuous exterior silicon sealant beads. Seal horizontal flush joints with a continuous silicone sealant bead.

G. Silicone setting blocks shall be furnished for support of glass and shall be sized and installed in accordance with glass manufacturers written recommendations.

H. Skylights shall be furnished with weep holes located at lower portion of extruded aluminum curb bar at each rafter connection for drainage of condensation to exterior.

I. Field cutting or trimming of rafter bars, caps, or glass light is not permitted.

J. Pressure bars shall be furnished for snap-in type glazing strips and shall have snap-on covers, so no exterior fastener is exposed.

K. Pressure bars shall be fastened with stainless steel fasteners into a system of alternate serrations. Fasteners shall be furnished so glazing strips are compressed to a predetermined amount of uniform compression. Fasteners shall be installed at 12 inches on center maximum.

L. Glass shall be installed with exterior silicone glazing strips.

M. Waterproofing shall be provided by means of continuous exterior silicon sealant beads. Horizontal flush joints require a continuous silicone sealant bead.

3.02 EXAMINATION

A. Examine the Work to determine that structure and substrate to receive system are properly prepared and ready to receive the Work of this section. Do not proceed until unsatisfactory conditions are corrected.

3.03 PREPARATION

A. Surfaces to be sealed shall be completely cleaned and dry. Verify and follow sealant manufacturer's written recommendations for proper cleaning, priming, and installation procedures.

B. Temperatures of the glass and aluminum surfaces shall be above 40 degrees F, during glazing and curing. Temperature range shall not vary more than 10 degrees F during sealant installation and curing.

C. Install components and glazing under direct observation of the skylight manufacturer's technical representative.

3.04 ISOLATION OF INCOMPATIBLE MATERIALS

A. Incompatible materials, such as aluminum and steel, shall be isolated from each other. Aluminum shall be furnished with one coat of zinc chromate, one coat bituminous paint, and further protected where required with isolation tape to prevent contact with incompatible materials and metal.

3.05 FIELD QUALITY CONTROL

A. Water flood test completed skylights in accordance with AAMA 501.1, 501.2 and 501.3.

3.06 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 PROTECTION

A. Protect the Work of this section until Substantial Completion.

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 Specifications, apply to this section.

1.02 SUMMARY

A. Section Includes: Finish hardware except as otherwise specified or specifically omitted herein.

B. Related Sections:

1. .
2. Section 08 11 13 - Hollow Metal Doors and Frames.
3.
4. Section 08 41 13 – Aluminum Framed Storefronts.

C. Specific Omissions: Hardware for the following is specified or indicated elsewhere.

1. Windows.
2. Cabinets and locks.
3. Signs.
4. Toilet accessories.
5. Installation.
6. Rough hardware.

1.03 REFERENCES

A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to Work of this Section where cited by abbreviations noted below (latest editions apply unless noted otherwise).

B. ADASAD – 2010 ADA Standards for Accessible Design.

C. ANSI - American National Standards Institute.

D. BHMA - Builders Hardware Manufacturers Association.

E. 2019 CBC - California Building Code, (CCR) California Code of Regulations, Title 24, Part 2, California State Accessibility Standards.

F. DSA - Division of the State Architect.

G. NFPA 80 - Fire Doors and Windows.

H. UL - Underwriters Laboratories

1.04 SUBSTITUTIONS & SUBMITTALS

A. Requests for substitutions must be made in writing 10 days prior to bid date to allow architect to issue an addendum. If proposing a substitute, submit that product data attached to one showing specified item and indicate savings to be made. Provide sample if requested. No other substitutions will be allowed.

1. Items listed with no substitute manufacturers have been requested by Owner to match existing.

B. SUBMITTALS: Submit six copies of schedule within 4 weeks after project has been awarded. Organize schedule into "Hardware Sets" with an index of doors and heading, indicating complete designations of every item required for each door or opening. Include the following information:

1. Type, style, function, size, quantity and finish of each hardware item. Use BHMA Finish codes as per ANSI A156.18.
2. Name, part number and manufacturer of each item.
3. Fastenings and other pertinent information.
4. Location of hardware set cross referenced to indications on drawings both on floor plans and in door schedule.
5. Explanation of all abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Obtain each kind of hardware (latch and lock sets, exit devices, hinges, and closers) from only one manufacture, although several may be indicated as offering products complying with requirements.

2. Hardware supplier shall be a direct factory contract supplier who has in his employment a certified hardware consultant (AHC) who is available at all reasonable times during the course of the work for project hardware consultation to the Owner, Architect, and Contractor.

B. Schedule Designations: Except as otherwise indicated, the use of one manufacturer's numeric designation system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish, function, or other quality of significance. See 1.04.A for substitutions.

1.06 REGULATORY REQUIREMENTS

A. Fire-Rated Openings: Comply with 2019 CBC Section 715 and NFPA No. 80. Provide only hardware tested and listed by UL for the type and size of each door required, which complies with the requirements of the door and frame labels.

1. Where exit devices are required on fire rated doors, provide supplementary marking on door UL label indicating “Fire Door to be Equipped with Fire Exit Hardware”, and provide UL label on exit device indicating “Fire Exit Hardware”.

B. Conform to applicable requirements of the 2019 CBC and Americans with Disabilities Act Accessibility Guidelines regarding accessibility requirements for door and entrance hardware.

C. Door hardware shall meet the requirements of 2019 CBC Sections 11B-404.2.7, 11B-, and 1008.1.8.

D. Hand activated door opening hardware, handles, pulls, latches, locks, and other operating devices on accessible doors shall have a shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist to operate, per 2019 CBC Section 11B-404. Mounting height of latching hardware shall be centered between 34 inches to 44 inches above the finished floor, per 2019 CBC Section 11B-404.2.7.

E. Pressure to operate doors shall not exceed 5 lbs. (22.2N) for exterior doors and 5 lbs. (22.2N) for interior doors. When fire doors are required, the maximum effort to operate the door shall not exceed 5 lbs. (22.2N), except that, when approved by the appropriate administrative authority, the maximum effort required to operate the door may be increased not to exceed 15 lbs. (66.72N), per 2019 CBC Sections 1008.1.2 and 11B-404.2.9.

F. Door closers and stops shall not reduce headroom to less than 78 inches. Door closers, when provided, shall have sweep period adjusted so that from an open position of 90 degrees the door will take at least 5 seconds to move to a position of 12 degrees from the latch, measured to the leading edge of the door, per 2019 CBC Sections 1003.3.1 Exception and 11B-404.2.8.1.

G. Thresholds shall comply with 2019 CBC Sections 1008.1.6 and 11B-404.2.5.

H. Floor stops shall not be located in the path of travel and 4 inches maximum from walls, per DSA Policy 99-08.

I. Hardware (including exit devices) shall not be provided with "Night Latch" (NL) function for any accessible doors or gates unless the following conditions are met per DSA Interpretation 10-08 DSA /AC (External), revised 4/28/09. Such conditions must be clearly demonstrated and indicated in the specifications:

1. Such hardware has a ‘dogging’ feature.
2. It is dogged during the time the facility is open.
3. Such ‘dogging’ operation is performed only by employees as their job function (non-public use).

J. Exit devices shall comply with 2019 CBC Section 1008.1.9

K. Exit devices shall be so mounted (centered between 36 inches and 44 inches above finished floor as recommended) that the clear width of the exitway is not less than 32 inches measured between the face of the door and the opposite stop, per 2019 CBC Section 11B-404.2.3 and Figure 11B-404.2.3.

L. The unlatching force of an exit device shall not exceed 5 lbs. (22.2N), applied in the direction of travel, per 2019 CBC Section 11B-404.2.9.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Individually package each unit of finish hardware complete with proper fastening and appurtenances, clearly marked on the outside to indicate contents and specific locations in the Work.

B. Deliver packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractor.

1.08 PROJECT CONDITIONS

A. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents.

B. Upon request, check the Shop Drawings for doors and entrances to confirm that adequate provisions will be made for the proper installation of hardware.

1.09 WARRANTY

A. Provide guarantee from hardware supplier as follows:

1. Closers: Five years, except electronic closers, two years.
2. Exit Devices: Two years.
3. All other Hardware: Two years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of manufacturers other than those listed shall be in accordance with paragraph 1.04.A.

Item:	Manufacturer:	Acceptable Substitute:
Continuous Hinges	Markar	Stanley, Hager
Butt Hinges	McKinney	Stanley, Hager
Locksets	Sargent	As specified
Cylinders	Medeco	As specified
Armor Collars	Keedex	equal
Exit Devices	Sargent	As specified
Surface Closers	Norton	As specified
Anti Vandal Pulls	Trimco	Sargent, Ives
Auto Flush Bolts	Trimco	Hager, Ives
Coordinators	Trimco	Hager, Ives
Kick Plates	Trimco	Hager, Ives
Door Stops	Trimco	Hager, Ives
Silencers	Trimco	Hager, Ives
Overhead Stops	Rixson	Sargent, ABH
Thresholds/Seals/Sweeps	Pemko	Reese, NGP

B. Furnish items of hardware required to complete the work in accordance with these specifications and the manufacturers' instructions. Items of hardware not specified shall be provided even though inadvertently omitted from this specification. Items shall be of equal quality and type.

C. Where the exact types of hardware specified are not adaptable to the finished shape or size of the members requiring hardware, furnish suitable types having as nearly as practicable the same operation and quality as the type specified, subject to Architect's approval.

D. Carefully inspect Project for the extent of the finish hardware required to complete the Work. Where there is a conflict between these Specifications and the existing hardware, furnish finish hardware to specification.

2.02 MATERIALS

A. Locksets: Locksets and latchsets shall be as specified. Strikes shall be 16 gage curved steel, bronze or brass with 1" deep box construction, and have lips of sufficient length to clear trim and protect clothing.

1. Comply with requirements of local security ordinances.
2. Provide approved fusible links at levers for labeled doors.
3. Lock Series and Design: Sargent 8200 series LW1L lever.

B. Butt Hinges: Outswinging exterior doors shall have nonremovable (NRP) pin. Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees.

1. Furnish 3 hinges per leaf to 7 foot, 6 inch height. Add one for each additional 30 inches in height or fraction thereof.
2. Provide 5 inch heavy weight hinges on doors over 3 feet 5 inches width.

C. Continuous Hinges: Hinge open widths shall be minimum, but of sufficient size to permit door to swing 180 degrees. Where necessary to maintain door clearance at jamb trim, frame conditions, door reveals and similar conditions, furnish wide throw hinges as approved by the Architect. Where door is indicated as having fire resistance rating, provide UL listed and labeled hardware.

D. Exit Devices: Furnish devices at wood doors with sex bolts unless otherwise specified. Lever handle trim shall match locksets.

1. Provide glass bead kits of proper thickness where the rail assembly of the exit device crosses a lite.

E. Surface Door Closers: Full rack and pinion type with removable non-ferrous case. Provide sex bolts and grommets at wood doors. Place closers inside building, stairs, and rooms. Closers shall be non-handed, non-sized, and installed to permit door to swing 180 degrees.

1. Flush transom offset brackets shall be used where parallel arm closers are listed for doors with fixed panels over.
2. Provide drop brackets, shoe supports, and blade stop spacers as required at narrow top rails.

F. Kick Plates: Provide with four beveled edges, .050 inches minimum thickness, 10 inches high by width less 2 inches. Furnish with machine or wood screws of bronze or stainless steel to match other hardware.

G. Floor Stops: Floor mounted door stops are prohibited where located in the path of travel. Where provided, install maximum 4 inches from wall surface.

H. Seals: Seals shall be finished to match adjacent frame color. UL label shall be applied on rated doors.

I. Screws: Exposed screws shall be Phillips head. Do not use self-drilling, self-tapping screws, unless furnished by hardware manufacturer for the specific condition or for mounting flat-goods such as push plates and kick plates.

J. Silencers: Furnish silencers for interior hollow metal frames, 3 for single doors, 2 for pairs of doors.

K. Thresholds: Change in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1 unit vertical to 2 units horizontal (50 percent slope). The floor or landing shall not be more than 1/2 inch lower than the threshold or doorway.

2.03 FINISH

A. Generally, to be BHMA 626 Satin Chromium.

1. Areas using BHMA 626 shall have push, pulls and kick plates of BHMA 630, Satin Stainless Steel, unless otherwise noted.

B. Spray door closers to match other hardware, unless otherwise noted.

C. Aluminum items shall be finished to match predominant adjacent material. Seals to coordinate with frame color.

2.04 KEYING REQUIREMENTS

A. Key into existing system as directed by the District. Contact the District Locksmith with Glendale Unified School District (818-242-0003) for keying requirements.

1. Key system shall be Medeco I/C core cylinder.

B. Stamp master keys and grand master keys with a registry number. Do not stamp “Master” or letter “M”.

C. Stamp individual room keys with plain identification number. Do not indicate key cut.

D. Factory cut keys and stamp “DO NOT DUPLICATE”.

E. Cylinders shall be Full Size Interchangeable Core (FSIC). Provide temporary cores for construction. Temporary cores shall be returned to the Contractor. District to change cores at completion of project and return temporary cores to Contractor.

F. Contractor and hardware supplier shall meet with the Owners Representative and Architect to establish the keying schedule and to provide the correct grand master, pass and change key groups to properly operate locking devices.

G. Provide record and registration system as directed by the Architect.

H. Locksets and cylinders shall be keyed, master keyed, and grand master keyed at the factory. Supply 4 change keys for each lock and one master and grand master for each set of locks.

I. Contractor shall be responsible for completion of keying schedule and ordering construction and permanent keys.

J. Key Control:

1. Permanent cores and sample set of permanent keys shall not be used during the construction phase of the Project. Temporary construction cores and keys used for securing the Work is included as part of the Work of this Section and shall be provided by the Contractor.

2. Upon Substantial Completion of the Work, sample set of original keys shall be returned to the District Representative. Duplication of District keys, or retaining keys, is not permitted.

3. Secure from District Locksmith a Letter of Authorization/Permission to order the District standard cylinders/cores.

4. Deliver keys directly to District Locksmith by registered security shipment direct from hardware manufacturer. Hardware supplier shall not cut keys.

PART 3 - EXECUTION

3.01 HARDWARE LOCATIONS

A. Mounting heights for hardware:

1. Lockset: 30 to 44 inches above finished floor. Verify manufacturers' template with door design.

2. Exit device: 36 to 44 inches above finished floor. Verify manufacturers' template with door design.

3. Door Pull: 40 inches from bottom of door to center of pull.

4. Floor Stop: Installed at a maximum of 4 inches from the face of the wall or partition.

B. Conform to CCR, Title 24, Part 2, and ADASAD for the positioning requirements for accessibility.

3.02 INSTALLATION

A. Pre-Installation Meetings: Initiate and conduct with supplier, installer, and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware, and door closers in the meetings.

B. Install each hardware item per manufacturer's instructions and recommendations. Do not install surface mounted items until finishes have been completed on the substrate. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

3.03 ADJUSTING

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.

B. Inspection: Hardware supplier shall inspect hardware furnished within 10 days of contractors request and include with his guarantee a statement that this has been accomplished. Inspector or Contractor will sign off the hardware as being complete and correctly installed and adjusted. Further corrections of defective material shall be the responsibility of his representative.

3.04 SCHEDULE OF DOOR HARDWARE

A. Legend of listed manufacturers:

KEE Keedex
MAR Markar
MCK McKinney
MED Medeco
NOR Norton
PEM Pemko
RIX Rixson
SAR Sargent
TRM Trimco

B. The last column in the Schedule of Door Hardware refers to the manufacturer listed above.

C. The Door Schedule on the Drawings indicates which Hardware Set is used with each door.

D. Schedule of Door Hardware:

HW-1
Exterior single door no. 7301B from Shop Floor to Exterior with Panic Hardware

1	CONTINUOUS HINGE	FM-300 x M-CHS2	630	MAR
1	EXIT DEVICE	16-8804 x LESS TRIM	630	SAR
1	I/C MORTISE CYLINDER	32W0200	626	MED
1	I/C RIM CYLINDER	32W0405H	626	MED
2	I/C CORE CYLINDER	32W0201	626	MED
1	ARMOR COLLAR	K-24	626	KEE
1	ANTI VANDAL PULL	1097HA-SP	630	TRM
1	SURFACE CLOSER	CPS7500-T	689	NOR
1	KICK PLATE	KO050 - 10 x 2 LDW B4E	630	TRM
1 SET	SOUND SEALS	S88 HEAD & JAMBS	BLK	PEM
1 SET	DOOR SEALS	2891S HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	AUTO DOOR BOTTOM	430MRL	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM
	Install door seals before closer and strike			

HW-2
Interior pair doors no. 7302, 7303, 7304 & 7305A from Shop Floor to Project Rooms and Wood Working with Storeroom Lockset and Closer

6	HINGE	TA2714 - 4-1/2 x 4-1/2	652	MCK
1	AUTO FLUSH BOLT	3810 (TOP BOLT ONLY)	626	TRM
1	LOCKSET	8238 x LW1L x L/CYL	626	SAR
1	I/C MORTISE CYLINDER	32W0200	626	MED
1	I/C CORE CYLINDER	32W0201	626	MED
1	COORDINATOR	3094 x 3095/3096 AS REQ'D	600	TRM
2	SURFACE CLOSER	PR7500	689	NOR
2	KICK PLATE	KO050 - 10 x 1 LDW B4E	630	TRM
1	FLOOR STOP	1214	626	TRM
1	ASTRAGAL	357 x TB	600	PEM
2	SILENCERS	1229A	GRY	TRM

HW-3

Exterior pair of door no. 6303A, 7305B & 7301A from Shop Floor to Exterior with Panic Hardware

2	CONTINUOUS HINGE	FM-300 x M-CHS2	630	MAR
1	EXIT DEVICE	8504 J SNB (Active)	630	SAR
1	EXIT DEVICE	8510 J SNB (Inactive)	630	SAR
2	I/C MORTISE CYLINDER	32W0200	626	MED
2	I/C RIM CYLINDER	32W0405H	626	MED
2	I/C CORE CYLINDER	32W0201	626	MED
2	ARMOR COLLAR	K-24	626	KEE
2	OFFSET PULL	1158	630	DON
2	CLOSER	281-P10xDXSNBxTORX	689	SAR
2	OVERHEAD HOLDER	105H	630	GLY
1	REMOVABLE MULLION	980 84”	630	SAR
1 SET	DOOR SEALS	2891S HEAD & JAMBS	628	PEM
1	DOOR SWEEP	57V	628	PEM
1	AUTO DOOR BOTTOM	430MRL	628	PEM
1	THRESHOLD	PER SILL DETAIL	628	PEM
	Install door seals before closer and strike			

END OF SECTION

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Glass and glazing as indicated.

C. Related Sections:

1. Section 08 41 13: Aluminum Framed Storefronts.

2. Section 08 11 13: Hollow Metal Doors and Frames.

3. Section 08 41 13: Aluminum Windows, Doors and Frames.

4. Section 08 71 00: Door Hardware.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's descriptive literature and installation recommendations for glass, glazing, and accessories.

B. Material Samples: Submit 6-inch square units of each type of glass specified.

1.03 QUALITY ASSURANCE

A. Labeling: Label each piece of glass and glazing and mirrors with manufacturer's name, and the grade or quality of the material. Labels shall be intact before and after installation. Fire-protection-rated glazing shall bear a label or other identification in accordance to CBC 715.4.6.3.

B. Comply with the following as a minimum requirement:

1. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

2. ASTM C1036 - Standard Specification For Flat Glass.

3. ASTM C1048 - Standard Specification For Heat-Treated Flat Glass —Kind HS, Kind FT Coated and Uncoated Glass.

4. CPSC 16 CFR 1201 - Safety Standards for Architectural Glazing Materials issued by the Consumer Products Safety Commission.

5. GANA - Glazing Manual.

6. Solar Heat Gain Coefficient (SHGC): 0.53 or better required to achieve HPI-CHPs pre-requisite points EE1.0 and EE1.1.

7. U-value: 0.78 or better required.

C. Qualifications of Installer: Minimum 5 years experience installing glass in projects of similar scope and complexity.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver glass and glazing materials with manufacturer's labels intact.

B. Do not remove labels until glass has been installed and inspected by Project Inspector.

C. Protect glass from staining, marking, and damage.

D. Putty and glazing compound shall be delivered to the Project site in manufacturer's original unbroken containers labeled to identify contents.

1.05 PROJECT CONDITIONS

A. Perform glazing when ambient temperature is above 40 degrees F.

B. Perform glazing on clean, dry surfaces only.

1.06 WARRANTY

A. Manufacturer shall provide a 10 year material warranty. Manufacturer shall provide a 20 year material warranty for coatings and thermally or acoustically rated insulation units against deterioration in acoustic or thermal rating.

B. Installer shall provide a 3 year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND FABRICATORS

A. To maximum extent possible, provide domestically manufactured and fabricated glass, and provide glass from one manufacturer.

B. Types of glass specified or indicated shall be manufactured or fabricated by one of the following:

1. Pilkington LOF (fire rated glazing).

2. PPG Glass Technology.

3. Visteon Float Glass Operations.

4. Viracon.

5. Oldcastle.

2.02 GLASS MATERIALS

A. General: Conform to ASTM C1036, ASTM C1048 and to ANSI Z97.1. Label factory cut panes.

B. Float Glass – Type G1: Oldcastle monolithic ¼ inch Pilkington Solar E on Clear Low-E #2 glass with Visible Light Transmittance (VLT) of 50% and Solar Heat Gain Coefficient of 0.25 and U-value of .36.

C. Tempered Glass: Condition A (uncoated surfaces), Type I or II, Class 1, Quality q3 (glazing select), Kind FT (fully tempered glass), match color of clear or tinted glass as applicable; fully thermal tempered, heat strengthening or chemical tempering is not permitted. Perform tempering by horizontal oscillating roller hearth or high speed roller hearth process. Do not permit fabrication processes leaving gripper or tong marks. Handle and size glass according to manufacturer's written instructions.

E. Clear Laminated Glass: 2 layers of 1/8 inch clear float glass with 0.030 inch thick high strength polyvinyl butyral laminating sheet. Edges of laminated glass shall be treated with Ardis 500, or equal, edge protection to prevent contact of laminating sheet with sealants.

F. All exterior facing glass shall be 1" nominal thickness insulating glass as follows:
(a) Outside pane to be 1/4" nominal thickness laminated glass consisting of:
(1) Outer lite of laminated glass assembly: 2.7 mm clear annealed glass
(b) Interlayer of laminated glass assembly: (1) 0.030 PVB interlayer.
(c) (1) Inner lite of laminated glass assembly: 2.7 with Cardinal 366 Low E on the #4 surface of the laminated glass assembly, (the #2 surface of the insulated glass assembly).
(d) Argon filled Gap 0.5 minimum
(e) Inner pane to be 3 mm clear (annealed/tempered) glass. Laminator shall be approved by the manufacturer.

2.03 GLASS SETTING MATERIALS

A. Setting Blocks: ASTM C864, channel shape; having 1/4 inch internal depth, Shore A hardness of 80 to 90 Durometer. Blocks shall be a minimum 2 inch long. Block width shall be approximately 1/16 inch less than the full width of the rabbet. Block thickness shall be at least 3/16 inch, sized for rabbet depth as required.

B. Spacers: ASTM C864, channel shape, with 1/4 inch internal depth, 3/32 inch flanges, web, 1/8 inch thick, one to 3 inches long. Spacers shall provide Shore A hardness of 40 to 50 Durometer.

C. Vinyl Glazing Channels: Profile compatible with framing system and designed to accommodate glass of specified thickness, light gray in color. Provide for dry glazing aluminum frames where indicated or permitted.

D. Glazing Tape: Poly-isobutylene based sealant tape, conforming to AAMA 804.1, with adhesive one side protected by temporary paper cover, Extru-Seal manufactured by Pecora Corp., No. 303 by Protective Treatments, Inc., or equal.

E. Spring Steel Spacers: Galvanized steel wire or strip designed to position glazing in channel or rabbet sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbet sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond-shaped pieces, 1/4 inch minimum size.

H. Glazing Sealants for Metal Sash: GE Silicones Silglaze II 2800, GE Silicones Silpruf, GE Silicones 1200 Silicone, and Dow Corning 999A. Polybutylene, oleoresinous, asphalt, and oil base sealants are not permitted. Provide sealant of same color as structural silicone sealant unless otherwise required.

I. Glazing Compounds and Sealants for Thermoplastic: Provide silicone, butyl, or polysulfide glazing compound.

PART 3 - EXECUTION

3.01 TOLERANCES

A. Thickness indicated or specified are nominal within standard tolerances. Maximum size of vertical panes shall not exceed following:

Glass Thickness Double Strength:	1/8 inch	3/16 inch	1/4 inch
Maximum Areas in Square Feet:	12	16	20

3.02 INSTALLATION, GENERAL

A. Glazed cabinet doors, windows, transoms, and fixtures, not otherwise noted or indicated, shall be glazed with clear float glass. Room or entrance doors shall be glazed with clear wire glass.

B. Glazing tapes or sealants shall be installed wherever glass contacts metal surfaces. Width of strips shall be as required.

C. Glazing compound shall be neatly and cleanly installed in straight lines, even with inside edge of sash members. Thumb puttying is not permitted.

D. Display Cases and Sliding Glass Doors in Casework: Glass in display cases shall be 1/4 inch thick clear wire glass or float glass as indicated. Edges of glass shall be rounded and polished.

3.03 INSTALLATION OF GLASS

A. Conform to requirements of GANA Glazing Manual.

B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

C. Provide compressible filler rods or equivalent back-up material to prevent sealant from extruding into glass channel weep systems, from adhering to back surface of joints and to control depth of sealant for optimum performance.

D. Force sealants into glazing channels, in manner to eliminate voids and to ensure complete bond of sealant to glass and channel surfaces.

E. Tool exposed surfaces of sealants to provide for drainage away from glass. Install pressurized tapes and gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

F. Where dry glazing of aluminum frame is indicated or permitted, provide vinyl glazing channels installed in accordance with frame manufacturers written recommendations. Do not stretch channels. Miter corners.

G. For tape glazing, furnish tape of thickness to provide approximately 30 percent compression. Cut tape to proper length and install to permanent stops, the entire length of the head and sill first, then to jambs. Butt tape together with no overlap and remove paper backing. Install glass on setting blocks at quarter points and maintain uniform glass edge clearance around entire perimeter of glass. Maintain manufacturer's recommended edge clearance and bite on glass. Install glass firmly into tape with a slight lateral movement to assure proper adhesion. Install tape to removable stop with evenly distributed firmness, smoothing out wrinkles in tape. Secure removable stop in proper position so tape makes

contact with glass as stop is installed, forcing contact with glass and completely sealing joint. Remove excess tape from both sides at slight angle over sight line. Do not undercut.

3.04 PROTECTION AND CLEANING

A. Protect exterior glass from breakage by furnishing crossed streamers attached to framing and away from glass surface. Do not directly install markers to glass surfaces. Remove non-permanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer. Glazing, which cannot be cleaned to a required condition, shall be deemed defective Work.

D. Remove and replace glass, which is broken, chipped, cracked, abraded, or damaged during construction.

E. Remove protective covering from thermoplastic not more than 4 days before Substantial Completion, and immediately before cleaning. Methods of final cleaning and finishing shall be as prescribed by thermoplastic glazing publications referenced above.

F. Wash glass on both faces not more than 4 days before Substantial Completion. Wash glass by method recommended by glass manufacturer. Do not furnish harsh cleaning agents, caustics, abrasives, or acids for cleaning. Polish glass both sides and leave free of soil, streaks, and labels.

3.05 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.06 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 22 16

METAL SUPPORT ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Metal support systems as indicated and/or described.

C. Related Sections:

1. Section 05 41 00: Load-Bearing Metal Studs.

2. Section 09 24 00: Portland Cement Plaster.

3. Section 09 29 00: Gypsum Board.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements: Comply with DSA and CBC requirements.

B. Design Requirements: Metal Studs: Studs for interior partitions shall be roll-formed channel or C-shapes.

2. Track: Stud track for floor and ceiling anchorage shall be channel configuration, sized to fit studs. Galvanized steel as manufactured for installation with specified metal studs.

3. Design: Design is based on minimum 5 pounds per square foot load applied perpendicular to walls. Deflection shall not exceed 1/240 under design load.

1.03 SUBMITTALS

A. Shop Drawings: Submit drawings showing framing, connection details, accessories and anchorage. Indicate location of assemblies and size and spacing of framing components.

B. Product Data: Submit manufacturer's catalog data for each item proposed for installation.

C. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

1.04 QUALITY ASSURANCE

A. Coordinate with related Work to provide blocking for items mounted on finished surfaces and to provide allowances for pipes and other items inside partitions and walls.

B. Comply with following as a minimum requirement:

1. American Welding Society (AWS): Structural Welding Code Steel (D1.1); and Structural Welding Code Sheet Steel (D1.3).

2. ASTM Standards:

a. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

b. ASTM A 1008 – Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High Strength Low-Alloy and High Strength Low-Alloy with Improved Formability.

c. ASTM A 641 – Standard Specification for Zinc Coated (Galvanized) Carbon Steel Wire.

d. ASTM C 645 – Standard Specification for Non-Structural Steel Framing Members.

e. ASTM C 955 – Standard Specification for Load Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging, for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

f. ASTM C 954 – Standard Specification for Steel Drill Screws for Application of Gypsum Panel Products or Metal Bases to Steel Studs From 0.033 Inch to 0.112 Inch in Thickness.

g. ASTM E 1190 – Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members.

C. Tolerances: Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting a 10 foot straightedge for its entire length at any location within a 1/8 inch tolerance. Install horizontal framing level within a tolerance of 1/8 inch in 12 feet in any direction.

1.05 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in their original unopened packages and stored protected from damage. Do not store material directly on grade. Provide adequate support to prevent bowing of material prior to installation.

B. Store welding electrodes in accordance with AWS D12.1.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products manufactured by one of following:

1. Dale/Incor.

2. Dietrich Industries, Inc.

3. Marino/Wade.

4. Cemco

5. Current members of Steel Stud Manufacturers Association (SSMA).

2.02 MATERIALS

A. Light Gage Metal Framing:

1. Metal framing shall be formed from corrosion resistant-steel conforming to requirements of ASTM A653, 33 ksi minimum, unless noted otherwise.

2. Metal framing shall be zinc coated in conformance to requirements of ASTM A926, G60.

3. Metal framing shall be manufactured in conformance to ASTM C645.

4. Install metal framing according to ASTM C1007, Standard Specification for Installation of Load-Bearing (Transverse and Axial) Steel Studs and Related Accessories.

B. Studs: SSMA, ICC ESR, minimum yield 33 ksi, hot-dipped galvanized or electro galvanized sheet steel, G-60, C Stud type, punched web (except tracks and joists), C-shaped, sizes required to conform to details and scheduled wall thicknesses. Studs shall be rolled from new steel sheet and shall not be produced from re-rolled steel. Stud flanges shall not be less than 1-5/16 inch wide; track flanges, not less than 1-1/4 inch wide.

1. Wall Framing and Furring for Plaster and Mortar Beds: Studs and tracks shall be 18 gage minimum, unless otherwise indicated.

2. Wall Framing and Furring for Gypsum Wallboard: Studs and tracks shall be 20 gage minimum, unless otherwise indicated.

3. Load-Bearing Studs: Studs and members thicker than 18 gage (0.0438 inch) shall conform to requirements of Section 05410, Load-Bearing Metal Studs.

4. Stud gages indicated on Drawings or specified are the minimum. Where required stud height and/or loads exceed code requirements or manufacturer's recommendations, provide heavier gage studs and/or decrease stud spacing as necessary to conform to code requirements.

C. Suspended and Furred Ceiling Systems and Wall Furring: Suspended ceiling framing system shall support finished ceiling, light fixtures, air diffusers, and accessories, as required. suspension system shall provide a maximum deflection of L/240. Carrying channels shall be fabricated from minimum 0.0548 inch thick cold-rolled steel, 1-1/2 inch wide x 7/16 inch deep. Carrying channels for supports under ducts shall be 2 inches in size as specified. Carrying channels shall be fabricated from hot-dip galvanized coated sheet.

1. Plaster Ceilings: Cross furring members shall conform to ASTM C 645, and shall be fabricated from cold-rolled steel, 3/4 inch wide x 7/16 inch deep. Furring members shall be fabricated from hot-dip galvanized coated sheet.

2. Gypsum Wallboard Ceilings: Furring members shall be fabricated from cold-rolled steel, 7/8 inch x 2-9/16 inches. Furring members shall be fabricated from hot-dip galvanized coated sheet.

D. Framed Ceilings: Framed ceiling system shall support finished ceiling, light fixtures, air diffusers, and accessories, as required. suspension system shall provide a maximum deflection of L/240.

1. Plaster and Gypsum Wallboard Ceilings: Ceiling joists shall conform to ASTM C 645, hot-dip galvanized coated steel, C-shaped, unpunched, 20 gage minimum thickness, unless noted otherwise.

E. Shaft Wall Framing Members: CH studs and J runners, 20 gage minimum for 2, 4 or 6 inch studs, conforming to ASTM 645, fabricated of steel conforming to ASTM A 653, hot-dip galvanized.

F. Framing Accessories: Provide all standard related accessories including floor and ceiling tracks, clips, web stiffeners, anchors, and similar items, of same manufacture as each type of stud specified, and as required for a complete installation.

G. Splay Wires and Compression Struts: Approved manufacturers acceptable to manufacturer of ceiling grids, gages and types as required by building codes for ceiling types and weights specified.

H. Wires: Soft-annealed galvanized steel wire, 8 gage for hanger wires and 16 gage for framing unless otherwise specified.

I. Fasteners: Wafer-head screws, self-drilling type for 20 gage metal and heavier. ASTM C954 self-drilling, self-tapping screws, Type S-12 pan head, ½ inch long.

J. Fire Rated Acoustical Foam Tape: Compressible, closed cell polyvinyl chloride foam with pressure sensitive adhesive, in rolls with protective release liner on non-adhesive face, 6 pounds per cubic foot density, 1 inch wide x not less than 1/4 inch thick, self-extinguishing, UL 94 recognized, Norseal V740FR, manufactured by Norton Performance Plastics Corporation, or equal.

K. Acoustical Sealant: Permanently resilient type, non-hardening, manufactured by USG, Gold Bond, or equal.

L. Zinc-Rich Paint: Conform to Fed Spec DOD-P-21035A, Z.R.C. "Cold Galvanizing Compound", manufactured by ZRC Products Company. Provide for touch-up of galvanized surfaces.

M .Steel Backing Plates: Provide a minimum 4 inch wide by l6 gage steel, or sections of studs and stud track welded or fastened to web of studs, except as otherwise indicated. Apply shop coat of metal primer.

N. Anchorage Devices Powder Actuated: Minimum 0.177 inch diameter by 1-7/16 inch long fasteners in regular concrete and 0.145 inch diameter by 1-1/8 inch long fasteners in lightweight concrete. Allowable shear and tension values as permitted in ICC ES Report shall be reduced to 80 percent.

O. Anchorage Devices, Drilled Expansion Anchors: Minimum 3/8 inch diameter with 2-1/4 inch embedment. Allowable shear and tension values as permitted in ICC ES Reports shall be reduced to 80 percent.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that overhead or concealed Work is completed, tested, inspected, and finished as required before starting Work of this section.

3.02 INSTALLATION

A. Walls and Partitions:

1. Fasten floor runners for exterior walls and interior partitions to concrete slab with required power driven fasteners. Spacing of fasteners not to exceed 16 inches on center.

2. Sound insulated walls and partitions: Embed floor runner tracks in two beads of acoustical sealant or two runs of compressible tape seal. Install top track nested into slotted track system, in same manner for full height of walls. Where wall ends abutting concrete, masonry, or steel set end studs in two beads of acoustical sealant or two tape seals and secure at 4-foot centers vertically.

3. Space studs not over 16 inch on center unless indicated otherwise. Studs shall be located approximately 2 inches from door frame jambs, abutting partitions and partition corners, except those providing support for door and window openings.

4. Furnish and install manufacturer's standard floor track. Fasten track to floor by means of 1/4 inch x 1-1/4 inch Star "Dryvin" hammer drive anchors or 3/16 inch x 1 inch round head, "Rawl-Drives" one-piece expansion bolts spaced not to exceed 3 feet, and installed in drilled holes in slab, or to wood joist with nails as indicated. Track may be fastened to concrete floor slabs with, power-driven fasteners.

5. Studs shall be seated squarely in track with stud web and flanges abutting track web, plumbed and securely fastened with sheet metal screws, to flanges or web of both floor and top tracks. Provide 4 screws per stud.

6. Where there is no suspended ceiling, tops of stud walls shall be provided with track and shoes and be fastened as specified for floors. Welding of studs to ceiling track will not be permitted except where bearing studs are installed.

7. Over metal doorframes, install a cut-to-length section of runner track, with flanges slit and web-bent to allow flanges to overlap adjacent vertical studs, and securely fasten to studs. At doorjambs, extend studs continuous to structure above.

8. Bridging, or horizontal bracing of 1-1/2 inch, cold-rolled channels shall be fastened in a manner to prevent stud rotation. Bridging shall be furnished as follows: walls up to 10 feet high, one row at mid-height; walls exceeding 10 feet high, bridging or bracing rows spaced not to exceed 5 feet on center.

9. Wind bracing shall be fastened where indicated on Drawings. Minimum size of strap shall be as indicated on Drawings. Track where strap terminates shall be anchored as indicated on Drawings.

B. Plaster Ceiling Suspension System:

1. Provide horizontal furring in accordance with CBC Table 2511.1.1.

2. Hanger Wires:

a. Hanger wires for ceilings suspended from wood frame construction shall be installed in accordance with CBC Table 2511.1.1 and shall be fastened with stem lag screws in bottom edge of joists or rafters. Wire shall be looped through hole in stem lag screw and then wrapped twice around it. Stem lag screws shall be "Stanlag Screws" by Stanline, Inc., or equal, of type and penetration as follows:

Type Size	Hanger Wire	Screw Penetration, Minimum
Stanlag #SLS-3	#12 & #10	1-1/4 inch
Stanlag #SLS-375	#9 & #8	1-1/2 inch

b. Hanger wire shall be wrapped twice around runner channel, drawn up taut, and wrapped twice around itself.

3. Runner channels shall be installed 6 inches maximum from walls, parallel to runners. Splices in runner channels shall be provided at hangers only, by lapping channels not less than 12 inches and tying channels together at 2 points with a double wrap of tie wire twisted up taut.

4. Ends of runner channels abutting concrete or masonry surfaces shall be 1-1/4 inch clear and shall be tied to wall or partition with 3/4 inch channel brackets providing a 4-inch right angle bend secured with two 1/4 inch by 1 inch power-driven fasteners. Brackets shall extend from face of surface not less than 8 inches and shall be tied to runner channels at 2 points with double wrap of tie wire twisted up taut.

5. Securely saddle-tie furring channels to runner channels at each crossing with 16 gage tie wire twisted up taut, and with wings left uncut and bent back.

C. Gypsum Wallboard Ceiling Suspension and Framing: Suspended ceiling system framing shall be installed in accordance with ASTM C 754, and as follows.

1. Hangers shall be spaced not more than 48 inches along runner channels and 36 inches in other direction or 42 inches in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other Work. Hangers at ends of runner channels shall be located not more than 6 inches from walls. Hanger wire shall

be fastened to structural elements with required fasteners. Sags or twists, which develop in suspended system, shall be adjusted. Damaged or faulty parts shall be replaced.

2. Main Runners: Hanger wires shall be double strand saddle-tied to runner channels and ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 6 inches of parallel wall to support ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 12 inches with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around channels.

3. Furring channels shall be fastened to runner channels and to structural supports at each crossing with tie wire, hairpin clips, or required fastenings. Furring channels shall be located within 2 inches of parallel walls and beams, and shall be cut 1/2 inch short of abutting walls.

4. Ceiling Openings: Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 1-1/2 inch main runner channels and vertically installed suspension wires or straps shall be located to provide at least minimum support specified for furring and wallboard attachment. Intermediate structural members not a part of structural system, shall be provided for attachment or suspension of support members.

5. Light fixtures and air diffusers shall be supported directly from suspended ceiling runners. Wires shall be provided at required locations to support weight of recessed or surface mounted light fixtures and air diffusers.

6. Control Joints: Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

    a. Interior Ceilings with Perimeter Relief: Control joints shall be installed so linear dimensions between control joints shall not exceed 50 feet in either direction or more than 2500 square feet in area.

    b. Interior Ceilings Without Perimeter Relief: Control joints shall be installed so linear dimensions between control joints shall not exceed 30 feet in either direction nor more than 900 square feet in area.

D. Splay Wires and Compression Struts: Install as detailed and as required to prevent upward and sideward motion under seismic conditions, as required by code.

E. Suspension Under Ducts: For hangers spaced at 4 to 5-1/2 foot centers, provide 6 gage hanger wires with minimum 2 inch runner channels spaced at maximum 48 inch centers. For greater spans, design system for live load of l0 pounds per square foot of area plus dead load and provide a detail in Shop Drawings.

F. Furring: Provide framing for horizontal furring as shown or required. Conform to above requirements as applicable.

3.03 CONNECTIONS TO METAL DECKING

A. Provide pre-molded neoprene filler strips matching flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.

B. The top runner track of fire-rated partitions shall be a minimum of 20 gage and fastened to metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Neither wallboard nor metal studs shall be fastened to top runner to allow for slab deflection. Areas above runner shall be friction fit with a minimum depth of 2-1/2 inch of 4 pounds per cubic foot mineral wool insulation. A minimum of 1/2 inch of firestopping compound shall be installed to each side of mineral wool insulation for 1-hour system, and 1 inch of firestopping for a 2-hour system. Install required special tracks, angles, fasteners and strips of gypsum wallboard as required to achieve required fire resistance rating.

C. Proprietary fire-rated top tracks are installed in accordance with manufacturer's recommendations and fire rating approval requirements.

3.04 CLEANING

A. Remove debris, rubbish, and waste material and legally dispose of off Project site.

3.03 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 24 00

PORTLAND CEMENT PLASTER

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Lath and Portland cement plaster and stucco as indicated.

2. Scratch coat plaster as a substrate for ceramic wall tile.

C. Related Sections:

1. Section 05 41 00: Load Bearing Metal Studs.

2. Section 09 22 16: Metal Support Assemblies.

1.02 DESIGN REQUIREMENTS

A. Provide pre-formulated finish coat products that require only addition of clean water for mixing.

1.03 SUBMITTALS

A. Shop Drawings: Submit elevations and details indicating locations and types of components, splices, connections and accessory items. Indicate locations and types of framing substrates.

B. Material Samples: Submit minimum 48 inch x 48 inch samples of each stucco and Portland cement plaster texture for review. Samples shall be representative of texture, color, and proposed workmanship. Maintain reviewed Samples on Project site for reference.

C. Product Data: Submit manufacturer's catalog data for each material and component proposed for installation.

D. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

E. Mock-ups: Provide a mock-up at least 10 feet x 10 feet x 1 foot. Include at least one control joint and, corner condition and one window opening flashing. Locate where required by the Architect.

1.04 QUALITY ASSURANCE

A. Coordinate with related Work to provide backing support for items mounted on finished surfaces and to provide allowances for pipes and other items in wall cavities.

B. Comply with the following ASTM Standard Specifications as a minimum requirement:

1. ASTM A641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.

2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

3. ASTM C150 – Standard Specification for Portland Cement.

4. ASTM C206 – Standard Specification for Finishing Hydrated Lime.

5. ASTM C841 - Standard Specification for Installation of Interior Lathing and Furring.

6. ASTM C842 – Standard Specification for Installation of Interior Gypsum Plaster.

7. ASTM C847 - Standard Specification for Metal Lath.

8. ASTM C897 – Standard Specification for Aggregate for Job Mixed Portland Cement-Based Plasters.

9. ASTM C926 – Standard Specification for Application of Portland Cement-Based Plaster.

10. ASTM C933 – Standard Specification for Welded Wire Lath.

11. ASTM C932 - Standard Specification for Surface-Applied Bonding Compounds for Exterior Plastering.

12. ASTM C1032 - Standard Specification for Woven Wire Plaster Base.

13. ASTM C1063 - Standard Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster.

14. ASTM C1509 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.

C. Exterior and Interior Lath: Where lath is fastened to wood supports, comply with CBC requirements.

D. Plaster: Conforming to requirements of the Portland Cement Plaster (Stucco) Manual published by the Portland Cement Association.

E. Metal Lath: NAAMM Standard ML/SFA 920 Guide Specifications for Metal Lath and Furring.

F. Adhesives and sealants shall meet the requirements of Low emitting Materials.

1. Meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1113, Adhesive and Sealant Applications (amended July 2007, or current version).

2. Adhesives and sealants shall be tested and meet VOC emission requirements of the California Department of Public Health's (CDPH) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Chambers (2004), including its 2004 Addenda.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect metal lathing and plastering materials before, during and after installation. In event of damage immediately provide required repairs and replacements.

B. Deliver and store Portland cement materials on the Project site in a manner to provide protection from exposure and damage by moisture. Pile materials to permit easy access for proper inspection and identification of each shipment. Stockpile adequate supplies of sand on the Project site to permit sampling and testing before installation. Store to avoid inclusion of foreign material.

C. Deliver plaster materials to the Project site in manufacturer's sealed and labeled packages.

PART 2 - PRODUCTS

2.01 LATH AND ACCESSORY MATERIALS

A. Each bundle of lath shall be sealed with a metal tag bearing the lath designation, weight and manufacturer's name.

B. Water Repellant Backing:

1. Weather-exposed for Horizontal Surfaces: W.R. Grace & Co., "Bituthene 4000" sheet, 0.060 inch thick, consisting of polyethylene sheet and rubberized asphalt, self-adhering, or equal.

2. Flashing and back-up for joints and reveals: W.R. Grace Co. VYCOR 0.040 inch thick rubberized asphalt, self-sealing and self-adhering, or equal.

C. Adhesives and sealers for water repellant backing: Types as recommended by manufacturer for installation with specified membrane sheet.

D. Expanded Metal Lath: ASTM C847, small diamond mesh expanded metal lath, 3.4 pounds per square yard, expanded from steel sheets with hot-dip galvanized coating G60 in accordance with ASTM A653. Lath shall be V-grooved self-furring type for installation over sheathing and flat type for installation over spaced framing. Install 3/8 inch ribbed lath when framing is over 24 inches on center.

E. Weather Barrier: Polypropylene Fabric Backing for Metal Lath - Tyvek, Typar, or equal.

F. Cornerite and Striplath: Flat or shaped lath reinforcing units, galvanized expanded metal weighing no less than 2.5 pounds per square yard, with 3 inch legs when formed for angle reinforcement and 2 inch minimum legs for galvanized wire type.

G. Plastering Accessories: Minimum 0.0172 inch galvanized steel or 0.0207 zinc alloy with expanded wings. PVC is not permitted. Furnish casing beads, expansion and control joints, weep and vent screeds.

1. Exterior Stress Relief Joints: Sizes and profiles, indicated or required. Control joints shall have expanded wings. Manufactured by Amico, Cemco, Dietrich, Keene or Superior.

    a. Expansion Joints: Two piece sections designed to accommodate expansion, contraction and shear forces.

    b. Control Joints: One-piece sections, with integral wings, installed as indicated on drawings, where cracks can be expected.

2. Drip Screed: Similar to Superior No. 10.

3. Casing Beads: Expanded flange type with minimum 7/8 inch grounds to establish plaster thickness.

4. Exterior Corner Reinforcement: Welded-wire type as manufactured by Stockton Products, Tree Island Industries Ltd. or Jaenson Wire.

5. Ventilating Screeds: Alabama Metal Industries, or equal, soffit vent screed, perforated web type, with integral plaster grounds.

6. Foundation Weep Screeds: Alabama Metal Industries, or equal, integral plaster ground and weep screed.

H. Fasteners:

1. Screws: USG corrosion resistant.

    a. Type S or S-12 for metal studs.

    b. Type A for wood and metal studs 20-25 gauge.

2. Wire for fastening lath to metal framing, fastening lath together and fastening corner beads, metal grounds and base screeds to lath and framing shall be 18 gage, galvanized conforming with ASTM A641.

3. Nails: 11 gage galvanized roofing nails, 7/16 inch head, barbed shanks, 1-1/2 inch long for horizontal application and providing a minimum of 3/4 inch penetration for vertical surfaces. Furnish fiber wadded furring nails for attaching lath to wood sheathing unless self-furred type of plaster reinforcement is approved.

4. Power driven nails shall be used for attaching lath to concrete and concrete masonry. Nails shall be a code recognized fastener such as Pneutek, Inc. fasteners or approved equal. Each fastener shall provide minimum withdrawal resistance of 50 pounds minimum.

5. Staples: Minimum 3/4 inch crown, 16 gauge galvanized steel. Staples shall have sufficient length to penetrate studs at least 3/4 inch.

I. Wire: Galvanized soft-annealed steel wire in conformance to ASTM A641.

1. Hanger wire for suspended ceilings, minimum 9 gauge.

2. Wire for fastening metal channels together, 16 gauge.

3. Wire for fastening lath to supports, tying ends and edges of lath sheets, and securing accessories to lath, 18 gauge.

2.02 PLASTER MATERIALS

A. Portland Cement: ASTM C150, Type II, low alkali.

B. Hydrated Lime: ASTM C206, Type S.

C. Sand: Washed natural sand conforming to ASTM C897, except gradation of sand shall be as follows:

Percentage retained, each sieve, by weight:

Sieve Size	Maximum	Minimum
No. 4	0	0
No. 8	10	0
No. 16	40	10
No. 30	65	30
No. 50	90	70
No. 100	100	95

D. Water: Clean, potable and from domestic source.

E. Exterior Finish Coat Plaster: Shall consist of one of the following systems:

1. Three Coat Systems: Mineral Stucco as fabricated by California Stucco, La Habra, Highland Stucco, Merlex, Omega Stucco, Inc, or equal. Furnish formulations requiring only addition of water for installation. Sand shall pass No. 20 sieve. Mix and sand shall provide specified finish. Furnish integral colored stucco in color as selected by Architect.

F. Plaster Bonding Agent: "Weld-Crete", manufactured by Larsen Products Co., Upco/Div., Emhart Corp. Bonding Adhesive No. 705, or Merlex Stucco "Acrylex".

G. Base Coat Reinforcement: Alkali resistant fiberglass shorts, 1/2 inch chopped strands, Type AR, manufactured by OCF, PPG Industries, or equal.

H. Plaster Patching Materials:

1. Bonding Agent: Acrylic resin type, Acryl 60, LHP Bonder, or equal.

2. Patching Plaster: Manufactured by Merlex Stucco, Inc., Orange, CA, or equal. Furnish fast setting, compatible with existing plaster materials, "Exterior Pronto Patch," Portland cement base coat material, requiring only addition of water. Material shall provide initial set within 20 minutes, and final set within one hour.

I. Underlayment: Single ply self-adhesive waterproofing membrane as manufactured by W.R. Grace Company, Jiffy-Seal by Protecto Wrap, or equal. Furnish for installation behind stress relief joints and backing on horizontal and vertical surfaces exposed to weather; under metal copings and flashings; and window jambs and sills.

J. Miscellaneous Material: Provide additional components and materials required for a complete installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that overhead or concealed Work is finished, completed, tested and inspected as required before starting Work of this Section.

3.02 INSTALLATION-WEATHER BARRIER MEMBRANE

A. Install one layer of underlayment over areas to receive lath with weather barrier membrane. Install horizontally with each course weather lapped 2 inches over layer below and 6 inches on ends.

B. Install lath over underlayment in accordance with manufacturer's instructions. Repair and seal tears and holes in weather barrier prior to applying plaster.

C. Install single ply self-adhesive waterproofing membrane per manufacturer's recommendations in areas indicated on the Drawings.

D. Flashing Around Openings: Install self-adhering, self-sealing membrane to make openings weather tight in accordance with details shown on drawings.

3.03 LATH INSTALLATION

A. General: Where exterior and interior lath is fastened to horizontal wood supports, the current edition of the CBC shall be complied with. Refer to Section 01420: Testing and Inspection.

B. Exterior Lathing, General: Comply with requirements of ASTM C1063 and ML/SFA 920, whichever is more restrictive.

1. Application of Metal Lath: Metal lath or wire fabric lath shall be installed in accordance with the provisions of CBC current editions. Lath shall be furred out from vertical supports or backing not less than 1/4 inch.

2. Self-furring lath meets furring requirements. Furring of expanded metal lath is not required on supports providing a bearing surface width of 1-5/8 inch or less.

3. Where external corner reinforcement is not installed, lath shall be furred out and carried around corners, extending and fastened to at least one support.

4. A weep screed shall be provided at or below foundation plate line on exterior stud walls. Screed shall be installed a minimum of 4 inches above grade and shall be of a type permitting water to drain to exterior of building. Weather-resistant barrier and exterior lath shall cover and terminate on attachment flange of screed.

5. Ends of lath on open framing (unsheathed) shall occur over supports. Where necessary, install additional studs to provide support for lath ends and support for separate flanges of stress relief joints.

3.04 PLASTER APPLICATION - GENERAL

A. Proportion, mix, apply and cure plaster in conformance with ASTM C926.

B. Install each plaster coat to an entire wall or ceiling panel without interruption to avoid cold joints and abrupt changes in uniform appearance of succeeding coats. Wet plaster shall abut existing plaster at naturally occurring interruptions in plane of plaster (such as corner angles, openings and control joints) wherever possible. Cut joining, where necessary, square and straight and at least 6 inches away from a joining in preceding coat.

C. Provide sufficient moisture or curing methods to permit continuous and complete hydration of cementitious materials, considering climatic and Project site conditions. If water cured, each basecoat shall be continuously damp for at least 48 hours, including weekends and holidays. Other curing methods, spray applied curing compounds such as Expo-Cure, or OEHS approved equal are permitted.

D. Provide sufficient time between coats to permit each coat to cure or develop enough rigidity to resist cracking or other damage when next coat is installed.

3.05 EXTERIOR PLASTERING

A. Concrete surfaces, except where noted as "Exposed Concrete" or "Painted Concrete," shall be finished with stucco dash finish coats, as specified.

B. Preparation of Surfaces:

1. Exterior concrete and masonry surfaces to be plastered shall be free of oily or waxy substances, and loose or foreign material. Uniformly spray with nozzle-type water spray at least 12 hours before installation of plaster.

2. Concrete and masonry surfaces to receive two coat application of 5/8 inch thick Portland cement plaster shall be treated with bonding agent. This surface preparation shall not be installed instead of a brown coat of plaster.

3. Concrete surfaces to receive stucco dash finish shall be lightly sandblasted to provide a roughened surface.

4. Verify that lath has been installed securely and that grounds, screeds, casing beads and other accessories are straight, in correct position, and securely fastened in place.

C. Number of Coats and Thickness: Exterior plaster shall be portland cement as follows with minimum thickness from face of supports or surfaces to finish face of plaster as follows:

1. Lathed Surfaces:

a. 3 coats, scratch, brown and finish, 7/8 inch thick, one inch thick where required by CBC.

b. 2 coats, controlled pre-mix single base coat and finish, 7/8 inch thick, one inch thick where required by CBC.

2. Stucco Dash Finish Coats: 2 coats, 1/8 inch thick.

D. Proportions:

1. Proportion ingredients for Portland cement. Calibrated boxes are required to determine the accuracy of proportioning. Proportions shall adhere to current edition of CBC.

2. Dash Bond Coat: Mixed in the proportion of 1 cubic foot of standard portland cement to 1-1/2 cubic feet of sand. Omit dash coat when bonding agent is used.

3. Stucco Finish: Stucco shall be factory prepared, exterior type, colored stucco containing a portland cement base, required aggregates and mineral pigments. Colors shall be as selected by the Architect. Selected colors are not limited to standard stock colors and certain Work, such as ceilings, soffits and walls, may be finished in non-standard colors as selected.

4. Acrylic Based Stucco Finish: Shall be factory prepared exterior type, acrylic based colored stucco finish. Colors and textures shall be as selected by the Architect.

E. Mixing: Provide plaster mix: cementitious materials and aggregate in proportions specified, furnishing only sufficient water to obtain proper consistency before installation. Do not mix any more material at any time than can be installed within 1/2 hour after mixing. Do not allow material to remain in mixer or mixing boxes overnight. Maximum allowable slump shall be 2-1/2 inch, based on a 2 inch by 4 inch by 6 inch slump cone.

F. Application:

1. Dash Bond Coat: Dash on concrete or masonry surfaces, leave undisturbed, and maintain damp for at least 24 hours following installation. Omit Dash bond coat when liquid bonding agent is used.

2. Scratch Coat: Install with sufficient material to completely cover laths and scratch across supports.

3. Brown Coat: Rod to a straight, true, even within 1/8 inch tolerance in 5 feet of surface and float to receive finish coat.

4. Single Base Coat: As an alternative to scratch and brown coats, apply in conformance to ASTM C926.

5. Stucco Finish Coat: Install in 2 coats to a total thickness of 1/8 inch, each coat covering surface uniformly. First coat shall completely cover basecoat with uniform color. Second color shall provide a uniform texture.

   a. First coat shall be installed by providing several passes with nozzle to completely cover surface.

   b. The second coat shall be installed by doubling back same day, when first coat is sufficiently dry.

c. Over concrete surfaces, second coat shall be installed 24 hours after installation of first coat. In warm weather, first coat shall be cured by light water spray after material has set.

d. Protection: Protect those surfaces, which are not to receive dash finish coats. Such surfaces shall be shielded and shall have any sand left from dashing operation removed.

G. Curing Exterior Plaster: Adhere to current edition of CBC for curing requirements.

H. Option for Machine Application, Scratch and Brown Coats, or Single Base Coat: Instead of hand installed plaster, the furnishing of plastering machines for interior or exterior scratch and brown coats or single base coat is permitted. Machine installation shall be in accordance with the following:

1. Qualifications: Provide proper equipment and apparatus.

2. Apparatus: Pump shall be equipped with an air pressure gage and required safety devices. Hoses and connections shall be tight and pressure shall be maintained constant.

3. Tests: Tests for determining proper consistency of plaster mix shall be taken at nozzle using slump cone method. Tests shall be observed by the IOR at least twice each day and as often as deemed necessary. Perform required tests and maintain an accurate log of such tests to ascertain compliance with material slump requirements. Material slump shall not exceed 2-1/2 inches at nozzle. Furnish an adequate number of standard 2 inch x 4 inch x 6 inch slump cones for testing. Cones shall be on the Project site before Work is started and at all times during performance of the Work of this section.

4. Proportion and Application: Proportioning, mixing, number of coats and thickness shall be same as specified for hand application. Cement aggregate and water shall be mixed to plaster machine. Plaster mix shall be projected into and conveyed through a hose to the nozzle at end of hose and deposited by pressure in its final position ready for manual straightening and finishing.

5. Follow-Up: Perform scoring operation of plaster, based on settings and drying conditions at time of installation. Curing shall be as previously specified.

6. Protection: Before installing any plaster, thoroughly protect other adjacent Work.

3.06 QUALITY CONTROL

A. Finish interior and exterior plaster to a uniform texture, free of imperfections and flat within 1/8 inch in 5 feet. Form a suitable foundation for paint and other finishing materials. Avoid joining marks in finish coats.

3.07 TESTING

A. Written certification of sand compliance is required. Samples of sand shall be obtained at the Project site. Tests may be performed as deemed necessary by the Project Inspector.

B. When plastering machine is used, provide a supply of 2 inch x 4 inch x 6 inch high cones for slump testing of Portland cement plaster. Samples of plaster taken at nozzle shall have a

maximum slump of 2-1/2 inches. Plaster material not complying with this requirement shall be deemed as defective Work.

3.08 REPAIR REQUIREMENTS FOR DAMAGED PLASTER

A. Plaster Detached from Framing:

1. Remove loose and broken plaster.

2. Repair or replace damaged water-resistant backing and lath in compliance with specified standards.

3. Remove stucco finish from surrounding area in the same plane by sandblasting.

4. Install a scratch coat and a brown coat mixed with liquid bonding agent instead of water to the areas devoid of plaster.

5. Install a coat of liquid bonding agent to entire wall plane.

6. Install a 1/8 inch thick stucco finish coat to entire wall plane and match existing texture and color.

B. Cracked Plaster 1/8 inch to 1/2 inch:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of stucco and liquid bonding agent.

3. Install a coat of liquid bonding agent to entire wall plane.

4. Install 1/8 inch thick stucco finish to entire wall plane and match existing texture and color.

C. Cracks Larger Than 1/2 inch - Painted:

1. Remove loose material from crack with a wire brush.

2. Fill crack with slurry of one part portland cement to 3 parts masonry/stucco sand and liquid bonding agent to match existing texture of adjacent surface.

3. Paint entire wall plane, color to match existing.

4. Where patching of plaster over existing lath is feasible, fasten loose lath and install new lath with nails at 6 inch centers. Where metal is furnished, lap new lath over existing 6 inches and tie at 6 inch centers. Install paper backings as required, shingled into existing..

5. Patching of Holes, Cracks, and Gouges: Holes, cracks, gouges, missing sections, and other defects in existing improvements shall be patched. For holes over 1 inch in size, cut small sections of lath and place in opening attached to existing material. Install 3 coats of plaster. For holes one inch and smaller, install bonding agent to existing surfaces and neatly fill hole with plaster, installing necessary coats to match adjacent surfaces, eliminate cracks and match existing surface texture. Cracks, gouges, and

other defects shall be filled with plaster or spackle as required and neatly finished to match adjacent existing improvements.

3.09 CLEANING

A. Remove rubbish, debris, and waste material and legally dispose of off the Project site.

3.10 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Gypsum board, sheathing and accessory components as indicated.

C. Related Sections:

1. Section 05 41 00: Load Bearing Metal Studs.

2. Section 07 92 00: Joint Sealants.

3. Section 09 22 16: Metal Support Assemblies.

1.02 SYSTEM DESCRIPTION

A. Design Requirements: Provide systems capable of resisting deflection as required by CBC and authorities having jurisdiction.

B. Regulatory Requirements: Comply with CBC requirements for design and installation.

1.03 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating complete ceiling suspension system including connections, anchorage, and trim features.

B. Material Samples: Submit 18 inch x 18 inch Samples of the texture coat of gypsum board panels with edges taped.

C. Product Data: Submit manufacturer's catalog data for each product proposed for installation.

D. Product Data verifying compliance with CHPS EQ2.2.1 for adhesives and sealants and CHPS EQ2.2.6 for materials.

1.04 QUALITY ASSURANCE

A. Comply with following as a minimum requirement:

1. ASTM C474 - Standard Test Methods for Joint Treatment Materials for Gypsum Board Construction.

2. ASTM C475 – Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

3. ASTM C514 – Standard Specification for Nails for the Application of Gypsum Board.

4. ASTM C840 – Standard Specification for Application and Finishing of Gypsum Board.

5. ASTM C919 – Standard Practice for Use of Sealants in Acoustical Applications.

6. ASTM C954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 inch to 0.112 inch in Thickness.

7. ASTM C1002 – Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

8. ASTM C1047 – Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

9. ASTM C1177 - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

10. ASTM C1178 – Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel.

11. ASTM 1325 – Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

12. ASTM C1396 – Standard Specification for Gypsum Board.

13. ASTM C1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.

14. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

15. ASTM D3274 - Standard Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation.

16. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

17. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

18. ASTM E695 - Standard Method for Measuring Relative Resistance of Wall, Floor, and Roof Construction to Impact Loading.

19. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

20. Underwriters Laboratories (ULI) requirements and listings for fire-rated materials and products classification.

21. GA 214 - Gypsum wallboard finish shall conform to requirements of GA 214, Application and Finishing of Gypsum Panel Products, published by the Gypsum Association, and as specified herein.

22. GA 600 - Gypsum wallboard shall conform to requirements of GA 600 Fire Resistance Design Manual, published by the Gypsum Association.

23. American National Standards for the Installation of Ceramic Tile.

24. ANSI A118.9 - Specification for Cementitious Backer Units.

B. Qualifications: Installer shall have a minimum 5 years experience in installing and finishing gypsum board.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, factory sealed packages, containers or bundles bearing brand name and name of manufacturer.

B. Materials shall be kept dry. Gypsum wallboard shall be neatly stacked flat; avoid sagging and damage to edges, ends, and surfaces.

C. Fire-rated materials shall have fire classifications numbers attached and legible.

D. Provide all means necessary to protect gypsum board systems before, during, and after installation.

E. Gypsum wallboard showing any evidence of water damage shall not be installed. Gypsum wallboard showing evidence of water damage after installation shall be removed and replaced.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Georgia-Pacific, National Gypsum Co., U.S. Gypsum Co., James Hardie, or equal.

2.02 MATERIALS

A. Gypsum Board Type X (fire-resistant): 5/8 inch thick, 4 feet wide and up to 16 feet long conforming to ASTM C1396 with long edges tapered.

GYPSUM BOARD SYSTEM			
Panel	**Fasteners**	**Joint Tape**	**Joint Treatment**

United States Gyp. Co.: 5/8" Sheetrock regular, type X, Firecode Core, or Firecode C Core Gypsum panels, as required by UL design.	Wood: 1 ¼" Type W drywall screws. Steel: 1 ¼" Type S or S-12 drywall screw.	Sheetrock paper tape Heavy Duty to meet ASTM C 475.	Sheetrock Setting Type, Lightweight Setting, Sheetrock Taping, Topping, or All-Purpose, Sheetrock Ready-Mixed Taping, Topping, or All-Purpose, or Sheetrock Lightweight All-Purpose or Ready-Mixed - Plus 3
Georgia-Pacific: 5/8" ToughRock regular, Fireguard or Fireguard C gypsum, as required by UL design.	Wood: 1 ¼" Type W drywall screws. Steel: 1 ¼" Type S or S-12 drywall screw.	Sheetrock paper tape Heavy Duty to meet ASTM C475.	Same as above
National Gypsum Co.: 5/8" Gold Bond regular, Fire-Shield or Fire-Shield C gypsum wallboard, as required by UL design.	Wood: 1 ¼" Type W drywall screws. Steel: 1 ¼" Type S or S-12 drywall screw.	ProForm Joint Tape, ProForm Multi-Flex Tape Bead, ProForm Fiberglass Mesh Tape to meet ASTM C 475.	. ProForm Multi-Use, ProForm All Purpose, ProForm Lite, ProForm Ultra, ProForm Taping, ProForm Triple-T, ProForm Topping, or ProForm Sta-Smooth, Sta-Smooth Lite, Sta-Smooth HS Joint Compound.

B. Impact Resistant Gypsum Board, Type X (fire-resistant): 5/8 inch thick, 4 feet wide and up to 16 feet long complying with one of the following:

1. Fire resistant rated gypsum core with additives to enhance impact resistance, faced with moisture and mold resistant paper, and complying with ASTM C1396.

2. Fire resistant, high density paperless gypsum with reinforcing fiber mesh.

3. Fire resistant fiberglass-mat faced gypsum board panels

GYPSUM BOARD IMPACT RESISTANT SYSTEMS			
Panel	**Fasteners**	**Joint. Tape**	**Joint Treatment**
United States Gyp. Co.: 5/8" Fiberock VHI Gypsum fiber panels.	Wood: 1 ¼" Type W drywall screws. Steel: 1 ¼" Type S-12 drywall screw.	Sheetrock paper tape Heavy Duty.	Sheetrock Setting compound.
Georgia-Pacific: 5/8" DensArmor Plus Impact Resistant Panels	Wood: 1 ¼" Type W drywall screws. Steel: 1 ¼" Type S-12 drywall screw.	Glass mesh.	Same as above.
National Gypsum Co.: 5/8" Hi-Impact XP gypsum wallboard.	Wood: 1 ¼"Type W drywall screws. Steel: 1 ¼" Type S-12 drywall screw.	ProForm joint tape.	Proform XP all-purpose joint compound.

C. Mold and Water Resistant Gypsum Board, Type X (fire-resistant): (Use at elevator shaft interior, and at restrooms above tile backer board), 5/8 inch thick 48 inch wide, up to 16 feet long conforming to ASTM C1396 with long edges tapered.

1. Resistance to Mold Growth: Minimum score of “10” when tested in accordance to ASTM D3273 and evaluated in accordance with ASTM D3274.

2. Resistance to Fungi: Maximum score of “0” when tested in accordance to ASTM G21.

GYPSUM BOARD MOLD RESISTANT SYSTEM			
Panel	**Fasteners**	**Joint Tape**	**Joint Treatment**
United States Gyp. Co.: 5/8" Sheetrock Mold Tough, Firecode Core, or Firecode C Core Gypsum panels.	Wood: 1 ¼” Type W drywall screws. Steel: 1 ¼” Type S or S-12 drywall screw.	Glass Mesh.	Setting-type joint compound rated 10 when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.
Georgia-Pacific: 5/8" Dens Armor Plus Fireguard or Fireguard C Interior Panels (Fire-Rated).	Wood: 1 ¼” Type W drywall screws. Steel: 1 ¼” Type S or S-12 drywall screw.	Same as above.	Same as above.
National Gypsum Co.: 5/8" Gold Bond XP regular, Fire-Shield or Fire-Shield C gypsum wallboard.	Wood: 1 ¼” Type W drywall screws. Steel: 1 ¼” Type S or S-12 drywall screw.	Same as above.	Same as above.

D. Gypsum Liner, Type X (fire-resistant): 1 inch thick 24 inch wide, up to 14 feet long, conforming to ASTM C1396 or C1658.

1. Resistance to Mold Growth: Minimum score of “10” when tested in accordance to ASTM D3273 and evaluated in accordance with ASTM D3274.

2. Resistance to Fungi: Maximum score of “0” when tested in accordance to ASTM G21.

GYPSUM BOARD SHAFTWALL SYSTEMS			
Panel	**Fasteners**	**Joint. Tape**	**Joint Treatment**
United States Gyp. Co.: 5/8" Mold Tough Type X Firecode Core, Gypsum panels, 3/4" Mold Tough Ultracode Core and 1" Mold Tough Liner panels.	1 ¼", 1 5/8", or 2 ¼" Type S or S-12 drywall screw.	Glass Mesh.	Setting-type joint compound rated 10 when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.
Georgia-Pacific: 5/8" ToughRock Fireguard, or ToughRock Fireguard, C gypsum board or DensArmor Plus Fireguard or Fireguard C Interior Panels (Fire-Rated) and 1" DensGlass Ultra Shaftliners panels.	1 ¼", 1 5/8", or 2 ¼" Type S or S-12 drywall screw.	Same as above.	Same as above.
National Gypsum Co.: 5/8" Gold Bond regular, Fire-Shield or Fire-Shield C gypsum wallboard and 1" Gold Bond Fire-Shield Shaftliner.	1 ¼", 1 5/8", or 2 ¼"Type S or S-12 drywall screw.	ProForm XP all-purpose joint compound.	Same as above.

E. Tile Backer Board, Type X (fire-resistant) @ restrooms and janitor closets:

1. Water resistant panels, 5/8 inch thick, 4 feet wide and up to 8 feet long conforming to conforming to one of the following requirements:

   a. Aggregated Portland cement board with polymer-coated, woven glass-fiber mesh embedded in front and back surfaces.

   b. Fiberglass-mat faced gypsum backing board complying with ASTM C1178.

   c. Cementitious board surfaced with fiberglass reinforcing mesh on front and back and complying with ANSI A118.9 and ASTM C1325.

2. Tile backer boards shall meet the following requirements:

   a. Resistance to Mold Growth: Minimum score of "10" when tested in accordance to ASTM D3273 and evaluated in accordance with ASTM D3274.

   b. Resistance to Fungi: Maximum score of "0" when tested in accordance to ASTM G21.

TILE BACKER BOARD SYSTEMS			
Panel	**Fasteners**	**Joint. Tape**	**Joint Treatment**
United States Gyp. Co.: 5/8" DUROCK Cement Board.	Wood: 1 1/2" galvanized roofing nails or 1 1/4" 1 5/8", or 2 1/4" DUROCK No. 8 wood screws. Steel:1 1/4" or 1 5/8" DUROCK No. 8 screws.	DUROCK glassfiber tape.	ANSI A136.1 Type I: Organic adhesive or ANSI A118.1acrylic latex modified dry-set mortar or ANSI A118.4 Latex Portland cement mortar.
Georgia-Pacific: 5/8" DensShield Fireguard Tile Backer.	Wood: 1 3/4" galvanized roofing nails or 1 5/8" Buglehead corrosion resistant, course thread, drywall screws. Steel: 1 1/4" Buglehead, corrosion resistant, fine thread, drywall screws.	2" wide fiberglass mesh tape.	ANSI A136.1 Type I: Organic adhesive or ANSI A118.1 acrylic latex modified dry-set mortar or ANSI A118.4 Latex Portland cement mortar.
National Gypsum Co.: 5/8" PermaBase Brand Cement Board.	Wood: 1 1/2" galvanized roofing nails or 1 1/4" or 1 5/8", PermaBase corrosion resistant screws. Steel: 1 1/4" or 1 5/8" Type S-12 screws.	PermaBase mesh tape. 2" wide polymer-coated (alkali resistant) mesh tape for interior applications. 4" wide polymer coated (alkali resistant) mesh tape for exterior applications.	Treat joints andset facing material with latex-Portland cement mortar or dry-set (thin-set) mortar. Mortars shall comply with ANSI A118.1 or A118.4 standards. Type I organic adhesive meeting ANSI A-136.1 for interior use only.
James Hardie Building Products Inc.: 1/2" or ¼" Hardibacker 500 Cement Board (for floor and countertop application at existing schools only).	Wood: 1 1/2" galvanized roofing nails. Wood and Steel: 1 1/4" No. 8 by 0.375 HD self drilling, corrosion resistant ribbed wafer head screws.	2" Wide High Strength. Coated, alkali-resistant, glass fiber reinforcing tape.	ANSI A136.1 Type I: Organic adhesive or ANSI A118.1acrylic latex modified dry-set mortar or ANSI A118.4 Latex Portland cement mortar.

F. Gypsum Sheathing, Type X (fire-resistant): 5/8 inch thick, 4 feet wide and up to 10 feet long fiberglass-mat faced gypsum backing board complying with ASTM C1177 or ASTM C1178.

1. Resistance to Mold Growth: Minimum score of "10" when tested in accordance to ASTM D3273 and evaluated in accordance with ASTM D3274.

2. Resistance to Fungi: Maximum score of "0" when tested in accordance to ASTM G21.

GYPSUM BOARD SHEATHING SYSTEMS			
Panel	**Fasteners**	**Joint. Tape**	**Joint Treatment**
United States Gyp. Co.: 5/8" Securock Glass-Mat Sheathing.	Wood: 1 ¼" # 6 buglehead corrosion-resistant fasteners. Steel: 1 ¼" Type S-12 drywall screw.		
Georgia-Pacific: 5/8" Densglass Gold Type "X"	Wood: 1 ¼" # 6 buglehead corrosion-resistant fasteners. Steel: 1 ¼" Type S-12 drywall screw.		
National Gypsum Co.: Gold Bond Brand e²XP Fire-Shield Extended Exposure Gypsum Sheathing.	Wood: 1 ¼" # 6 buglehead corrosion-resistant fasteners. Steel: 1 ¼" Type S-12 drywall screw.		

2.03 ACCESSORIES

A. Metal Trim: Paper-faced metal drywall beads and trim meeting ASTM C1047, as manufactured by USG/Beadex, National Gypsum, or equal. Trim units shall be of size and type to fit gypsum board construction and shall include corner beads, casings, edge trim and other shapes indicated and required.

B. Mold Resistant Joint Compound: As recommended by board manufacturer, OnePass by CTS Cement Manufacturing Co., or equal, meeting the following requirements:

1. Minimum score of "10" when tested in accordance with ASTM D3273 and evaluated in accordance with ASTM D3274.

2. Shall conform to ASTM C475.

C. Joint Tapes: Shall conform to ASTM C475.

D. Finishing Materials:

1. High solids primer shall be SHEETROCK Brand First Coat manufactured by USG or High-build primer by Sherwin Williams, or equal.

2. Texture coat finish material shall be manufactured by U.S. Gypsum, Hamilton, or Highland Stucco and Lime Products, Inc., or equal.

E. Acoustical Sealant: Non-hardening, non-shrinking, for use in conjunction with gypsum board, as recommended by Board Manufacturer and conforming to ASTM C919.

F. Fasteners:

1. Self-drilling, self-tapping bugle-head drywall screws; in conformance to ASTM C1002. No. 6 Type S or S12, 1 1/4 inch long for metal framing,

2. Wood framing:

a) Nails: Hot dip, 11 gauge galvanized nails with 7/16 inch head and 1-1/4 inch minimum length.

b) Screws: Type W 1-1/4 inch minimum length for single-layer panels. Screws shall be furnished with a corrosion-resistant treatment.

3. Adhesive: as recommended by board manufacturer and in compliance to ASTM C557.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Metal Trim:

1. Provide corner beads at outside corners and angles, metal casing where gypsum board terminates at uncased openings, metal edge trim where board edges abut horizontal and vertical surfaces of other construction.

2. Install trim in accordance with manufacturer's directions with appropriate joint compound. Install trim in longest practical pieces.

B. Gypsum Board:

1. Install gypsum board in conformance with ASTM C840.

2. Gypsum board shall be cut by scoring and breaking or by sawing, working from face side. Where board meets projecting surfaces it shall be scribed and neatly cut. Unless conditions require otherwise, gypsum board shall be installed first to ceilings, then to walls. End joints shall occur over a support. Install panels of maximum practical length so a minimum number of end joints occur.

3. End joints shall be staggered and joints on opposite sides of a partition shall be arranged to occur on different studs. Joint layout at openings shall be installed so no end joints will align with edges of openings.

4. Except where specified otherwise, fasteners shall be spaced not less than 3/8 inch from edges and ends of gypsum board. Do not stagger fasteners at adjoining edges and ends.

5. Install gypsum board vertically or horizontal as permitted by specific UL Design at walls. Fasten board with drywall screws spaced not to exceed 8 inch on centers around perimeter of boards and 8 inches on centers on intermediate studs. Space screws at 8 inches on centers along top and bottom runners. Screws shall be driven to provide screwhead penetration just below gypsum board surface without breaking surface paper. Where electrical outlet and switch boxes are indicated, provide adjustable attachment brackets between studs.

6. Install gypsum board to ceiling framing with long dimension at right angles to furring channels, or wood framing members, and fasten with specified drywall screws or nails spaced 6 inch to 7 inch on centers across board. Screws or nails shall be not less

than 1/2 inch from side joints and 3/8 inch from butt end joints. Abutting end joints shall occur over furring channels and end joints of boards shall be staggered. Support cutouts or openings in ceilings with furring channels.

7. Install access doors, furnished under another section, in correct location, plumb, or level, flush with adjacent construction, and securely fastened to framing.

3.02 TOLERANCES

A. Install gypsum board flat within 1/8 inch in 10 feet.

3.03 JOINT TREATMENT AND FINISHING

Level	Joints	Interior Angles	Accessories	Fasteners	Surface
1	Tape set in compound	Tape set in joint compound			Tool marks and ridges acceptable
2	Tape set in joint compound and one separate coat of joint compound	Tape embedded in joint compound and wiped to leave a thin coat of compound over tape, and one separate coat	Covered by one separate coat of joint compound	Covered by one separate coat of joint compound	Free from excess joint compound. Tool marks and ridges acceptable.
3	After taping, cover with two separate coats of joint compound	After taping, cover with one separate coat of joint compound	Covered by 3 separate coats of joint compound	Covered by 2 separate coats of joint compound	Smooth and free of tool marks and ridges *
4	After taping, cover with 2 separate coats of joint compound	After taping, cover with one separate coat of joint compound	Covered by 3 separate coats of joint compound	Covered by 3 separate coats of joint compound	Smooth and free of tool marks and ridges *
5	After taping, cover with 2 separate coats of joint compound	After taping, cover with one separate coat of joint compound	Covered by 3 separate coats of joint compound	Covered by 3 separate coats of joint compound	Skim coat of joint compound applied to entire surface. Surface free from tool marks and ridges. *

*At completion of specified taping and finishing, install one coat of high solids primer as specified hereafter

B. All Levels: Install tape bedding compound, tape, and finishing cement on joints in wallboard as required for specified levels of finish.

C. Levels 2 through 5:

1. Install joint cement and finishing cement over screw heads. Treat all inside corners with joint cement, tape, and finishing cement. Treat outside corners with corner beads and finishing cement.

2. Provide metal casing beads at all edges of gypsum wallboard, which abut ceiling, wall, or column finish, and elsewhere as required, such as openings, offsets, etc. Install all exposed joints, trims, and attachments non-apparent following installation of paint or other finishes. If joints and fasteners are visibly apparent, correct defects as required.

3. Seal raw edges of plumbing openings and boards that have been cut to fit with sealing compound brushed on.

4. When entire installation is completed, correct and repair broken, dented, scratched or damaged wallboard before installation of finish materials by other trades.

D. Levels 3 and 4: Install one coat of high solids primer over entire surface.

E. Level 5: Install one coat of skim coat over entire surface, followed by one coat of high solids primer over entire surface.

3.04 REQUIRED LEVELS OF FINISH

A. Unless otherwise indicated or specified, levels of finish required shall be as follows:

1. Level 1: Plenum areas above ceilings, insides of shafts, and other concealed areas. Taping to be as required for fire rated assemblies.

2. Level 2: Water-resistant wallboard backing for high moisture areas to be covered with a water resistant surface other than tile, vinyl or paint, i.e stainless steel cladding etc.

3. Level 3: Backing for vinyl wall covering and adhered acoustic tile. Also, provide where textured finish is indicated.

4. Level 4: Exposed painted wallboard in classrooms, utility rooms, and similar spaces not requiring Level 5 finish.

5. Level 5: Exposed, painted wallboard in offices and corridors.

3.05 TEXTURE COAT

A. Spray install texture coat to interior gypsum board surfaces where indicated on Drawings.

B. Texture coat shall provide a uniform splatter pattern finish with an 80 percent minimum coverage of surface.

C. Provide protection from spray for interior surfaces of electrical boxes and wiring.

3.06 CLEAN-UP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.07 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Topset coved rubber base for installation with surface flooring.

C. Related Sections:

1. 03 35 00: Polished Concrete Finishing.

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1.02 SUBMITTALS

A. Product Data: Submit manufacturer's published technical data describing materials, construction and recommended installation instructions. Submit technical data and installation instructions for each adhesive material.

B. Maintenance Instructions: Submit manufacturer's recommendations for maintenance, care and cleaning of base.

C. Samples: Submit Samples of top set base in each available color. Following color selections, submit Samples, not less than 12 inches long of each selected color and type. Submit pint cans of each type adhesive.

D. Maintenance Materials: Before Substantial Completion, deliver at least 50 lineal feet and 5 outside corner units of each color of rubber base installed. Deliver the materials in unopened factory containers or in sealed cartons with labels identifying the contents, matching installed materials. Include unopened cans of adhesives adequate to install the maintenance materials.

E. Product Data verifying compliance with CHPS EQ2.2.1 for adhesives and sealants and CHPS EQ2.2.3 for materials.

1.03 QUALITY ASSURANCE

A. Qualifications of Installer: Minimum 5 years experience in successfully installing the same or similar flooring materials.

B. Comply with the following as a minimum requirement:

1. ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM F 1861: Standard Specification for Resilient Wall Base.

3. All chemically based products such as sealers, primers, fillers, adhesives, etc. must be approved Low Emitting Materials..

4. Each selected color and configuration shall be from same dye lot and color.

1.04 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to the Project site in original unopened manufacturer's packaging clearly labeled with manufacturer's name. Store materials at room temperature, but not less than 70 degrees F, for a minimum of 48 hours before installation, unless otherwise indicated in manufacturer's printed instructions.

1.05 PROJECT CONDITIONS

A. Ventilation and Temperature: Verify areas that are to receive rubber base are ventilated to remove fumes from installation materials, and areas are within temperature range recommended by the various material manufactures for site installation conditions.

1.06 WARRANTY

A. Manufacturer shall provide a 5 year material warranty.

B. Installer shall provide a 2 year labor warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Burke/Mercer Wall Base.

B. Roppe, Pinnacle Rubber Base.

C. Flexco Company, Wallflower Premium Rubber Wall Base.

2.02 MATERIALS

A. Rubber base: Conform to ASTM F 1861; Group 2, solid (homogeneous); Type 1, TS, (thermoset) vulcanized rubber, Style A, 4 inch high unless otherwise indicated, integral colors as selected, non-shrinking, 1/8 inch thick, with matching molded outside corners.

B. Base Adhesive: Water based, low odor type, as recommended by manufacturer of rubber base.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate the Work of this section with other sections to provide a level, smooth and clean finish surfaces to receive rubber base.

3.02 EXAMINATION

A. Field verify dimensions and other conditions affecting the Work of this section before commencing the Work of this section.

B. Before Work is started, examine surfaces that are to receive rubber base. Deficiencies shall be corrected before starting the Work of this section.

3.03 PREPARATION

A. Do not start preparation until adjacent concrete floor slabs are at least 90 days old and finish flooring is installed.

B. Install rubber base when ambient temperature is 70 degrees F. or higher.

3.04 INSTALLATION

A. Install top set base at all hard floors, including resilient flooring, concrete and wood, carpet and other soft floors, unless otherwise indicated on drawings.

B. Securely fasten cement base to backing in long lengths in accordance with manufacturer's recommendations. Lay out lengths so that not less than 18 inches long filler pieces are provided. Assure that top and toe continuously contact the wall and floor, and that all joints are tight. Install matching factory formed external corners at all offsets. All inside corners shall be coped; wrapped corners are not acceptable.

C. Use of adhesive gun is prohibited. Apply adhesive directly to substrate using the appropriate notched trowel or spreader according to manufacturer's instructions. Maintain 1/8 inch gap from top of base to prevent adhesive oozing onto adjacent surfaces.

D. Base and outside corners shall be rolled with a seam roller before adhesive sets.

3.05 CLEANING

A. Maintain surfaces of base clean as installation progresses. Clean rubber base when sufficiently seated and remove foreign substances.

B. Clean adjacent surfaces of adhesive or other defacement. Replace damaged and/or defective Work to the specified condition.

3.06 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

3.07 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 09 72 16

TACKABLE WALL SURFACING

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Tackable Wall Surfacing

B. Related Sections/Items:

1. Division 01:
2. Primer/sealer application on gypsum board substrate, refer to Section 09 90 00.
3. Markerboards and tackboards, refer to Division 10.

1.2 SUBMITTALS

A. Comply with provisions as outlined in Division 01 and Section 01 33 00.

B. Product data indicating compliance with specified requirements.

C. Installation instructions.

D. Samples:

1. (3) 6”x 9” (150mm x 225mm) samples of each type of Wall Surfacing material required.

1.3 QUALITY ASSURANCE

A. Fire Performance Characteristics: Comply with fire performance characteristics indicated below. Identify components with markings from testing and inspection organization.

1. ASTM E-84 (Fuel Contribution) – Class B
2. NFPA 225 (Critical Radiant Flux) – Class II

B. Single Source Responsibility: Obtain tackable wall covering system components from a single source.

C. Deliver materials in original factory wrappings and containers, clearly labeled with manufacturer, brand name, and fire hazard classification.

D. Store materials in original undamaged packages and containers inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within the storage area at not less than 70^{o}F (21^{o}C) during the period materials are stored.

E. Mock-ups: Prepare mock-ups for Architect’s review and to establish requirements for seaming and finish trim.

1. Correct areas, modify method of application/installation, or adjust finish texture as directed by Architect to comply with specified requirements.
2. Maintain mock-ups accessible to serve as a standard of quality for this Section.

3. Install sample panel of each type wall covering specified.
4. Install panels in areas designated by Architect.

F. Adhesives and sealants shall meet the requirements low emitting materials:

1. Meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1113, Adhesive and Sealant Applications (amended July 2007, or current version).

2. Adhesives shall be tested and meet VOC emission requirements of the California Department of Public Health's (CDPH) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Chambers (2004), including its 2004 Addenda.

G. Wall surfacing materials shall meet the requirements of low emitting materials:

1. Materials shall be tested and meet VOC emission requirements of the California Department of Public Health's (CDPH) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Chambers (2004), including its 2004 Addenda.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperature within building at not less than 68ºF (20ºC) for a minimum of 72 hours prior to beginning installation.

1. Do not install Bulletin Board until the space is enclosed and weatherproof. The temperature of the building should not be less than 68ºF (20ºC) for a minimum of 72 hours prior to installation.
2. Do not install Bulletin Board until the temperature is stabilized and the permanent lighting is in place.

1.5 MAINTENANCE

A. Maintenance instructions: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

B. Extra materials: Deliver to Owner extra materials from same production run as installed products. Package with protective materials.

1. Provide 5% of amount installed.

1.6 WARRANTY

A. Manufacturer's standard 5-year limited warranty.

PART 2 – PRODUCTS

2.1 PRODUCTS

A. Manufacturer: Forbo Linoleum, Inc., Humboldt Industrial Park, P.O. Box 667, Hazleton, PA 18201 or approved equal. Phone: 800-842-7839. Phone: 570-459-0771. Fax: 570-450-0258. Email: info@fL-NA.com. Website: www.forboflooringNA.com.

B. Forbo Bulletin Board: Uni-color linoleum resilient homogeneous tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments calendared onto a natural burlap backing. Color shall extend through thickness of material.

1. Bulletin Board Linoleum resilient tackable surface material: Width 48 inches and as required by the Drawings. Gauge: ¼-inch. 90-linear feet rolls (approximately). Minimum corner bend 2-3/4-inches. Dimensionally stable due to burlap backing.

2. All products shall be SMART Platinum certified.

3. Color: TBD

2.2 ACCESSORIES

A. Adhesive: Solvent free, SBR type linoleum adhesive; or polyvinyl acetate dispersion type (contact cement) when used in press.

B. Forbo L910 adhesive.

C. Aluminum trim as shown on the Drawings and Details.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which Bulletin Board will be installed.

1. Complete finishing operations, including painting, before beginning installation of Bulletin Board materials.
2. Wall surfaces to receive tackable wall surfacing material shall be dry and free from dirt, grease, loose paint and scale.
3. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface preparation: Remove hardware, accessories, plates and similar items to allow tackable wall surfacing to be installed.

1. Plaster surface: Remove surface chalk. In new work use moisture meter to determine moisture content. Do not begin installation when moisture content is greater than five percent.
2. Gypsum board surface: Recess nails and screws. Repair irregular tape joints, sand and remove dust.
3. Painted surfaces: Remove loose paint or scale. Sand surface of enamel or gloss paint and rinse with clear water.
4. Ensure gypsum wallboard surfaces scheduled to receive Bulletin Board are properly primed under Section 09 90 00.

B. Prime substrate as recommended by manufacturer.

3.3 APPLICATION

A. Comply with manufacturers printed installation instructions.
B. Apply adhesive with 1/16-inch square notch trowel to area to receive sheet.
C. Work from top to bottom then side to side. Roll sheet firmly into adhesive for positive contact and to remove air bubbles.
D. Remove adhesive residue immediately.
E. Scribe, cut and fit material to butt tightly to adjacent surfaces, built-in casework and permanent fixtures and pipes.
F. Lap and double cut seams.
G. Joints: Butt joint: Butted.
H. Trim: Aluminum edge trim framing all edges.

3.4 CLEANING

A. Clean wall covering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.

B. Remove excess adhesive using methods and materials recommended by manufacturer.

3.5 PROTECTION

A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION

SECTION 09 91 00

PAINTING AND COATING

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Interior and exterior painting.

C. Following items shall not be painted:

1. Brass valves, chromium or nickel-plated piping and fittings.

2. Boiler control panels and control systems.

3. Fabric connections to fans.

4. Flexible conduit connections to equipment, miscellaneous name plates, stamping, and instruction labels and manufacturer's data.

5. Mechanical and electrical utility lines, piping and heating and ventilation ductwork in tunnels, under-floor excavated areas or crawl spaces, attic spaces and enclosed utility spaces.

6. Flag, floodlight, parking light poles and loudspeaker poles, metal stairs, handrails and chain-link fence with a galvanized finish, unless otherwise noted.

7. Structural and miscellaneous steel, open web steel joists and metal floor decking, which will not be exposed in final construction, shall have no finish other than one coat of shop primer.

8. Hardboard covering on tops and backs of counters and benches.

9. Brass, bronze, aluminum, lead, stainless steel and chrome or nickel-plated surfaces.

10. Non-metallic walking surfaces unless specifically shown or specified to be painted.

1.02 SYSTEM DESCRIPTION

A. Regulatory Requirements:

1. Paint materials shall comply with the Food and Drug Administration’s (F.D.A.) Lead Law and the current rules and regulations of local, state and federal agencies governing the use of paint materials.

1.03 SUBMITTALS

A. List of Materials: Before submittal of samples, submit a complete list of proposed paint materials, identifying each material by distributor's name, manufacturer's name, product name and number, including primers, thinners, and coloring agents, together with manufacturers' catalog data fully describing each material as to contents, recommended installation, and preparation methods. Identify surfaces to receive various paint materials.

B. Material Samples: Submit manufacturer's standard colors samples for each type of paint specified. Once colors have been selected, submit Samples of each color selected for each type of paint accordingly:

1. Samples of Paint and Enamel must be submitted on standard 8 ½" x 11" Leneta Opacity-Display Charts. Each display chart shall have the color in full coverage. The sample shall be prepared from the material to be installed on the Work. Identify the school on which the paint is to be installed, the batch number, the color number, the type of material, and the name of the manufacturer.

2. Elastomeric shall be submitted in duplicate samples of the texture coating. Samples will be not less than 2 ½" by 3 ½" in size and installed upon backing. Finished Work will match the reviewed Sample in texture.

3. All materials and color samples shall be reviewed before starting any painting.

C. For transparent and stained finishes, prepare samples on same species and quality of wood to be installed in the Work, with written description of system used.

1.04 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, the manufacturer shall provide written certification the materials comply with the requirements of this section.

B. Coats: The number of coats specified is the minimum number. If full coverage is not obtained with the specified number of coats, install additional coats as required to provide the required finish.

C. Install coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer as reviewed by the Architect.

D. Paint materials shall comply with the following as a minimum requirement:

1. Materials shall be delivered to Project site in original unbroken containers bearing manufacturer's name, brand number and batch number.

2. Open and mix ingredients on premises in presence of the Project Inspector.

E. Paint materials shall meet the requirements of for Low Emitting Materials:

1. Meet the VOC content requirements in the applicable category of South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings (amended July 2007, or current version).

2. All products shall comply with the requirements of the Safe Drinking Water and Toxic Enforcement Act of 1986 and the most current list of chemicals (Proposition 65, CA OEHHA). Products that are labeled or would require labeling under this law are not eligible for this credit.

3. Paints and coatings shall be tested and meet VOC emission requirements of the California Department of Public Health's (CDPH) Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Chambers (2004), including its 2004 Addenda.

1.05 DELIVERY, STORAGE AND HANDLING

A. Storage and Mixing of Materials: Store materials and mix only in spaces suitable for such purposes. Maintain spaces clean and provide necessary precautions to prevent fire. Store paint containers so the manufacturer's labels are clearly displayed.

1.06 SITE CONDITIONS

A. Temperature: Do not install exterior paint in damp, rainy weather or until surface has thoroughly dried from effects of such weather. Do not install paint, interior, or exterior, when temperature is below 50 degrees F, or above 90 degrees F, or dust conditions are unfavorable for installation.

1.07 WARRANTY

A. Manufacturer shall provide a 3 year material warranty.

B. Installer shall provide a 3 year labor warranty.

1.08 MAINTENANCE

A. Provide at least one gallon of each type, color and sheen of paint coating installed. Label containers with color designation indicated on Drawings.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Furnish the products of only one paint manufacturer unless otherwise specified or required. Primers, intermediate and finish coats of each painting system must all be the products of the same manufacturer, including thinners and coloring agents, except for materials furnished with shop prime coat by other trades.

B. Factory mix paint materials to correct color, gloss, and consistency for installation to the maximum extent feasible.

C. All paint materials to be minimum "Architectural Grade".

D. Gloss degree standards shall be as follows:

HIGH GLOSS	70 and above	EGGSHELL	30 to 47
SEMI-GLOSS	48 to 69	SATIN	15 to 29

2.02 MANUFACTURERS

A. Acceptable manufacturers, unless otherwise noted:

1. Dunn-Edwards Corporation Paints
2. Frazee Paints & Wall coverings
3. Vista Paints
4. Sherwin Williams
5. ICI Paints

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine surfaces to receive paint finish. Surfaces which are not properly prepared and cleaned or which are not in condition to receive the finish specified shall be corrected before prime coat is installed.

B. New woodwork shall be thoroughly cleaned, hand sandpapered, and dusted off. Nail holes, cracks or defects in Work shall be filled. On stained woodwork, fill shall be colored to match stain. Filling shall be performed after the first coat of paint, shellac or varnish has been installed.

C. Plaster surfaces except veneer plaster shall be allowed to dry at least 3 weeks before painting. Veneer plaster shall be allowed to dry sufficiently to receive paint as determined by moisture meter tests.

D. Metal surfaces to be painted shall be thoroughly cleaned of rust, corrosion, oil, foreign materials, blisters, and loose paint.

E. Do not install painting materials to wet, damp, dusty, dirty, finger marked, rough, unfinished or defective surfaces.

F. Concrete surfaces shall be dry, cleaned of dirt and foreign materials and in proper condition to receive paint. Neutralize spots demonstrating effects of alkali.

G. Mask off areas where necessary.

3.02 APPLICATION

A. Backpainting: Immediately upon delivery to the Project site, finish lumber and millwork shall be backpainted on surfaces that will be concealed after installation. Items to be painted shall be backpainted with priming coat specified under "Priming".

B. Priming: New wood and metal surfaces specified to receive paint finish shall be primed. Surfaces of miscellaneous metal and steel not embedded in concrete, and surfaces of unprimed plain sheet metal Work shall be primed immediately upon delivery to the Project site. Galvanized metal Work and interior and exterior woodwork shall be primed immediately after installation. Priming of surfaces and priming coat shall be as follows:

1. Knots, Pitch and Sap Pockets: Shellac before priming.

2. Exterior Woodwork and Wood Doors: Prime with one coat of exterior waterborne emulsion wood primer.

3. Interior Woodwork: Where indicated to be painted, prime with one coat of waterborne wood primer.

4. Stain: Woodwork indicated to receive a stain and varnish finish shall be stained to an even color with water borne stain. On open-grained hardwood, mix stain with paste filler and completely fill pores in wood.

5. Galvanized Metal Work: Clean oil, grease and other foreign materials from surfaces. Install vinyl wash pretreatment coating. Follow manufacturer's instructions for drying time, and then prime with one coat of metal primer.

6. Unprimed Iron, Steel, and Other Uncoated Metals: Where specified to be painted, prime with one coat of metal primer.

7. Shop Primed Metal Items: Touch up bare and abraded areas with metal primer before installation of second and third coats.

8. Coats shall be installed evenly and with full coverage. Finished surfaces shall be free of sags, runs and other imperfections.

C. Allow at least 24 hours between coats of paint.

D. Rollers shall not be used on wood surfaces.

E. Each coat of painted woodwork and metal, except last coat, shall be sandpapered smooth when dry. Texture-coated gypsum board shall be sanded lightly to remove surface imperfections after first coat of paint has been installed.

F. Each coat of paint or enamel shall be a slightly different tint as required. Each coat of paint, enamel, stain, shellac, and varnish will be inspected by the Project Inspector before next coat is applied. Notify the Project Inspector that such Work is ready for inspection.

1. Tinting Guideline: The first coat, primer/undercoat(s) to be untinted or tinted up to 50% lighter or darker (at the discretion of the installer) than the finish coat. The second coat (or third coat if a seal coat and undercoat have been specified) is to be factory tinted in the range of 10% to 15% lighter or darker (at the discretion of the installer) than the finish coat. The final coat is to be factory tinted to the required color selected. These tinting guidelines shall be provided on all surfaces receiving paint.

G. Do not "paint-out" UL labels, fusible links and identification stamps.

H. Paint Roller, brush and spray.

1. Only Paint rollers shall be used on interior plaster, drywall, masonry/plaster and plywood surfaces, nap shall not exceed one half (1/2) inch in length.

2. First coat on wood overhang and ceilings shall have material applied by roller and then brushed out in a professional manner to leave surface free of imperfections. Finish coat may be sprayed.

3. All other surfaces shall have all coatings applied with brushes of proper size.

4. Spray work is permitted only on radiators, acoustic plaster, masonry and plaster.

I. Where ceilings are specified to be painted, beams, cornices, coves, ornamental features, plaster grilles, etc. shall be included.

J. All ceilings shall be white, including Shop rooms, storage rooms, etc.
Underside of exposed deck shall be as noted on the drawings.

3.03 CLEANING

A. Remove rubbish, waste, and surplus material and clean cabinets, hardware, floors, and other adjacent Work.

B. Remove paint, varnish and brush marks from glazing material and, upon completion of painting Work, wash and polish glazing material both sides. Glazing material, which is damaged, shall be removed and replaced with new material.

C. Clean hardware and other unpainted metal surfaces with recommended cleaner. Do not furnish abrasives or edged tools.

3.04 SCHEDULE

A. Interior:

1. Woodwork, Painted: 3 coats.

a. First Coat: As specified in this section under Priming.

b. Second and Third Coats: Interior enamel, semi-gloss or gloss as indicated.

2. Plaster: 4 coats.

a. First Coats: Pigmented wall sealer.

b. Second coat: Enamel under coater.

c. Third and Fourth Coats – Interior enamel, semi-gloss or gloss as indicated.

3. Gypsum Board: 4 coats.

   a. First Coat: Drywall sealer.

   b. Second Coat: Enamel under coater.

   c. Third and Fourth Coats: Interior enamel, semi-gloss or gloss as indicated.

4. Concrete: 3 coats.

   a. First: Concrete sealer.

   b. Second and Third: Interior enamel, semi-gloss or gloss as indicated.

5. Concrete Block: 3 coats.

   a. First: Concrete block filler.

   b. Second and Third: Interior enamel, semi-gloss or gloss as indicated.

6. Metal: Shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include, but are not limited to: exposed structural and miscellaneous steel, metal doors and frames, ladders, table and bench legs.

   a. First Coat: Metal primer.

   b. Second and Third Coats: Interior gloss enamel, except metal doors and frames which shall be semi-gloss or gloss to match adjacent wall.

B. Exterior:

1. Plaster and Stucco: 2 coats. Flat 100% acrylic.

   a. Exterior 100 percent acrylic.

2. Concrete: 3 coats. Flat 100% acrylic.

   a. First Coat: Concrete sealer.

   b. Second and Third Coats: Exterior 100 percent acrylic.

3. Concrete Block: 3 coats. Flat 100% acrylic.

   a. First Coat: Concrete block filler.

   b. Second and Third Coats: Exterior 100 percent acrylic.

4. Metal: 3 coats. Shall be cleaned and pre-treated. Items to be painted include, but are not limited to: steel columns and miscellaneous steel items, gravel stops, metal doors and frames, hoods and flashings.

   a. First Coat: As specified in this section under Priming.

   b. Second and Third Coats: Exterior gloss enamel.

C. Mechanical and Electrical Work:

1. Except where interior mechanical and electrical Work to be painted is specified to receive another paint finish, Work occurring in finished rooms and spaces shall be cleaned, pre-treated, and painted with 3 coats. Items to be painted include, but are not limited to: steel and copper piping, pipes, vents, fittings, ducts, plenums, miscellaneous supports and hangers, electrical conduit, fittings, pull boxes, outlet boxes, unfinished surfaces of plumbing fixtures, miscellaneous metal cabinets, panels, and access doors and panels.

   a. First Coat: As specified in this section under Priming.

   b. Second and Third Coats: Interior enamel, semi-gloss or gloss to match adjacent wall or ceiling finish.

2. Insulation and Taping on Pipes and Ducts: 3 coats.

   a. Finished Rooms:

      - First Coat: Interior waterborne primer.

      - Second and Third Coats: Interior semi-gloss or gloss enamel to match adjoining wall or ceiling finish.

   b. Building Exterior:

      - First Coat: Exterior waterborne primer.

      - Second and Third Coats: Exterior gloss enamel.

3. Inside surfaces of ducts, vents, dampers and louvers as far back as visible from room in which they open shall be painted with 2 coats of flat black paint.

3.05 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.06 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 09 96 00

HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:

1. Exterior Substrates:
   a. Steel.

B. Related Requirements:
1. Section 05 12 00 Structural Steel Framing
2. Section 09 91 00 Painting and Coatings

1.3 DEFINITIONS

A. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D523.

B. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D523.

C. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.

2. Indicate VOC content.

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in the Exterior High-Performance Coating Schedule and the Interior High-Performance Coating Schedule. Include color designations and product runs (batch numbers).

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each coating system.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg .

B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or comparable product by one of the following:

1. PPG Paints
2. Corotech Coatings; Benjamin Moore & Co.
3. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
4. Sherwin-Williams Company (The).
5. Tnemec Inc.

2.2 HIGH-PERFORMANCE COATINGS, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
3. Products shall be of same manufacturer for each coat in a coating system.

C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Nonflat Paints and Coatings (High Gloss): 50 g/L.
4. Floor Coatings: 50 g/L.
5. Primers, Sealers, and Undercoaters: 100 g/L.
6. Rust-Preventive Coatings: 100 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Zinc-Rich Industrial Maintenance Primers: 100g/L.

D. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 75 percent of paints and coatings by volume or surface area shall comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" using CDPH Standard Method v1.2-2017.

E. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Fiber-Cement Board: 12 percent.
3. Masonry (Clay and CMUs): 12 percent.
4. Wood: 15 percent.
5. Gypsum Board: 12 percent.
6. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and coating systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.

D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any.

E. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 7/NACE No. 4.
2. SSPC-SP 11.
3. SSPC-SP 6/NACE No. 3.
4. SSPC-SP 10/NACE No. 2.
5. SSPC-SP 5/NACE No. 1.

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
1. Use applicators and techniques suited for coating and substrate indicated.

2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.

C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness (DFT) Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for DFT.

1. Contractor shall touch up and restore coated surfaces damaged by testing.
2. If test results show that DFT of applied coating does not comply with coating manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide DFT that complies with coating manufacturer's written instructions.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Epoxy System [**MPI EXT 5.1F**]:

a. Prime Coat: Primer, epoxy, anti-corrosive, for metal[**, MPI #101**].

1) PPG Paints; Amerlock 2 AL Aluminum Epoxy Mastic; applied at 4.0 to 8.0 mils DFT.
2) PPG Paints; Amercoat 235 Multi-Purpose Phenalkamine Epoxy; applied at 4.0 to 8.0 mils DFT.
3) PPG Paints; Amercoat 385 PA High-Build, Multi-Purpose Polyamide Cured Epoxy; applied at 3.0 to 8.0 mils DFT.

b. Intermediate Coat: Epoxy, high build, low gloss[**, MPI #108**].

1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
1) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

c. Topcoat: Epoxy, semi-gloss.

1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
2) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

d. Topcoat: Epoxy, gloss.

1) PPG Paints; HPC High Gloss Epoxy, 95-501 Series; applied at 4.0 to 8.0 mils DFT.

2. Epoxy over Self-Priming Epoxy System[**MPI EXT 5.1S**]:

a. Prime Coat: Epoxy, high build, self-priming, low gloss.

1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
2) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

b. Intermediate Coat: Epoxy, matching topcoat.
c. Topcoat: Epoxy, semi-gloss.

1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
2) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

d. Topcoat: Epoxy, gloss.

1) PPG Paints; HPC High Gloss Epoxy, 95-501 Series; applied at 4.0 to 8.0 mils DFT.

3. Epoxy Deck Coating over Epoxy Primer and High-Build Epoxy System[**MPI EXT 5.1V**]:

a. Prime Coat: Primer, epoxy, anti-corrosive[**, MPI #101**].

1) PPG Paints; Amerlock 2 AL Aluminum Epoxy Mastic; applied at 4.0 to 8.0 mils DFT.
2) PPG Paints; Amercoat 235 Multi-Purpose Phenalkamine Epoxy; applied at 4.0 to 8.0 mils DFT.
3) PPG Paints; Amercoat 385 PA High-Build, Multi-Purpose Polyamide Cured Epoxy; applied at 3.0 to 8.0 mils DFT.

b. Intermediate Coat: Epoxy, high build, low gloss[**, MPI #108**].

1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
2) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

c. Topcoat: Epoxy deck coating[**, MPI #82**].

1) PPG Paints; HPC High Gloss Epoxy, 95-501 Series + NSA; applied at 4.0 to 8.0 mils DFT.
2) PPG Paints; Amerlock 400 High Solids Epoxy + NSA; applied at 4.0 to 8.0 mils DFT.

4. Epoxy Deck Coating over Self-Priming Epoxy System[**MPI EXT 5.1X**]:

   a. Prime Coat: Epoxy, high build, self-priming, low gloss.

      1) PPG Paints; Aquapon High Build 97-1212; applied at 4.0 to 6.0 mils DFT.
      2) PPG Paints; Amerlock 400 High Solids Epoxy; applied at 4.0 to 8.0 mils DFT.

   b. Topcoat: Epoxy deck coating[**, MPI #82**].

      1) PPG Paints; HPC High Gloss Epoxy, 95-501 Series + NSA; applied at 4.0 to 8.0 mils DFT.
      2) PPG Paints; Amerlock 400 High Solids Epoxy + NSA; applied at 4.0 to 8.0 mils DFT.

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SECTION 10 11 00

VISUAL DISPLAY SURFACES

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Wall mounted markerboards of size indicated on Drawings.

C. Related Sections:

1. Section 09 91 00: Painting and Coating.

1.02 SUBMITTALS

A. Shop Drawings: Shop Drawings to indicate gages, profiles, sections of materials, details of construction, hardware, methods of attachment and/or anchoring, as applicable for specified materials.

B. Samples: Submit the following:

1. 3 inch x 5 inch markerboard Samples, provide manufacturer’s full range of colors.

C. Product Data: Submit manufacturer’s technical data, product specifications, installation instructions, and other pertinent information as applicable for each product or material specified.

D. Test Reports: Submit certified laboratory test reports as applicable to indicate compliance with specified requirements.

1.03 QUALITY ASSURANCE

A. Manufacturer shall have been regularly engaged in the business of manufacturing markerboards for at least 5 years.

B. Comply with requirements and recommendations of applicable portions of Porcelain Enamel Institute - PEI 2.

1.04 PRODUCT HANDLING

A. Deliver materials to the Project site with manufacturer's labels intact and legible.

B. Provide all means necessary to protect markerboards before, during and after installation.

1.05 JOB CONDITIONS

A. Sequencing, Scheduling:

1. Coordinate with related Work of other sections including gypsum board and tackboards.

2. Do not install markerboards until paint is installed to surfaces concealed behind them.

1.06 SPECIAL PROJECT WARRANTY

A. Manufacturer shall provide a 50 year material warranty.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS (MARKERBOARDS)

A. Greensteel, Inc., a division of Polyvision Corporation.

B. Nelson Adams.

C. Claridge Inc.

2.02 SYSTEM PERFORMANCE

A. System shall be comprised of factory assembled markerboards, in configurations and sizes indicated on the Drawings or as specified herein.

B. Laminations of panel components shall be by face sheet manufacturer.

2.03 MATERIALS

A. Wall-Mounted Markerboards: Greensteel “AZ” Series, as a standard of quality:

1. Dry markerboards shall be porcelain enamel steel manufactured to exceed the performance specifications for porcelain enamel S104 of the Porcelain Institute. Markerboards shall be capable of supporting papers by means of magnets. The writing surface shall resist wear and damage from shock and abrasion and shall not dent, shatter or crack. The surfaces shall retain original color, writing, and erasing qualities and shall not become glossy or shiny in normal use. The gloss variation of a surface shall not exceed 3 units when measured by a 45 degree gloss meter in accordance with the Porcelain Enamel Institute Bulletin 1-18 Gloss Test for Porcelain Enamels and ASTM C 346.

2. Steel: Base metal shall be high quality enameling iron or steel of low metalloid and copper content, especially manufactured and processed for temperatures over 1,400 degrees F. used in coating porcelain on steel units for Architectural purposes; minimum 24 gage.

3. Facing Surfaces:

a. Board surfaces shall consist of the following:

1) Primer coat, 0.0025 inch minimum thickness.

2) Vitreous-porcelain writing surface coating of 0.0025 inch minimum thickness.

3) The reverse side of the steel base sheet shall receive a ground coat of 0.0005 inch thickness and a spray coat of silicon.

4) The panel edges at butt joints shall be porcelain enamel.

5) Fuse cover and ground coats to the steel at the manufacturer's standard firing temperature, but at least 1,250 degrees F.

2. The dry markerboard surfaced steel shall be factory laminated to 7/16 inch thick fiberboard core. A moisture blocking backing sheet shall be provided.

a. Fiberboard Core shall be #45 pound particle board.

b. Moisture Barrier Backer Sheet shall be minimum .015 aluminum or 28 gauge galvanized steel. Backer sheet shall be factory laminated to the core under pressure.

5. Lamination: The surface facing and the backing shall be bonded to the core material by means of a special flexible adhesive developed for this purpose with no unbonded area. The face and back shall not be removable without rupturing the core material. Panels shall not delaminate under normal use.

6. Joints: Where vertical joints occur, a 14 gage continuous concealed steel spline shall be fitted tightly into grooves in the core material. Factory rabbet to produce a smooth butt joint. Do not furnish exposed trim.

7. Edge Trim:

a) Alloy 6063-T5, extruded, anodized satin finish aluminum.

8. Chalktray: Furnish manufacturer's standard continuous flat-ribbed or box-type aluminum chalktray with stained front and cast plastic end closures for each chalkboard and markerboad.

a. Extend chalktray to end of both vertical edges of the board.

b. On flat-rib tray, provide 3/4 inch radius on corners and polish at ends.

c. Maximum projection from finish face of wall: 4 in.

9. Map Rail: Furnish map rail at the top of each unit, complete with the following accessories:

a. Display rail: Provide continuous cork display rail two inch wide, as indicated, integral with the map rail. Extend display rail to end of both vertical edges.

b. End stops: Provide one end stop at each end of the map rail.

c. Map hooks: Provide 2 map hooks with flexible paper holder clips for each 8 feet of map rail or fraction thereof.

d. Roller Map Bracket: Provide 2 for each 8 feet of map rail or fraction thereof

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install markerboard, trim, map rail and marker tray in accordance with manufacturer's directions and reviewed Shop Drawings. Fasteners for assembly of trim and frame units shall be truss head aluminum or stainless steel self-tapping screws with double cadmium-plated finish.

B. Install panels after finish painting of wall surfaces has been completed and paint is cured. Install panels level, plumb and neatly assembled. Before Substantial Completion, trim shall be completely cleaned of dirt, finger-marks, or other foreign material.

C. Install panel guides, spacers, and panels at media wall cabinets as indicated.

3.02 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.03 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Interior and exterior accessibility, identification, directional and informational signs.

2. Exterior building signs.

C. Related sections:

1. Section 32 13 13: Concrete Paving.

2. Section 08 11 13: Hollow Metal Doors and Frames.

3. Division 9: Finishes.

1.02 REFERENCES

A. Regulatory Requirements:

1. CAS/CAR – California Accessibility Statutes and California Accessibility Regulations current edition.

2. California Building Code, Title 24.

3. California Title 19.

4. ADA Design Guidelines, current edition.

B. Standards:

1. ADASAD – 2010 ADA Standards for Accessible Design.

2. ASTM D4802 Standard Specification for Poly (Methyl Methacrylate) Acrylic Plastic Sheet.

3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

4. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.03 SUBMITTALS

A. Product Data: Submit material descriptions, finishes and color charts for each type of sign.

B. Shop Drawings: Submit Shop Drawings indicating sign style, lettering, overall dimensions and quantities. Submit floor plans showing locations for each sign.

C. Material Samples: Submit three samples illustrating full size sample sign, of type, style and color specified.

D. Manufacturer's installation instructions.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference: Notify OAR when signs are ready for installation. Arrange for conference at site. Do not proceed with installation until Architect's approval of specific locations and methods of attachment has been obtained.

B. Provide signs from one manufacturer, unless otherwise approved.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site and protect from damage. Store until immediately prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.

1. H. Toji and Company, Long Beach, CA.

2. Karman Ltd., Architectural Signs, Canoga Park, CA.

3. Vomar Products Inc., Canoga Park

4. ASI-Modulex, Inc., Culver City, CA.

5. Mohawk Sign Systems, Inc., Schenectady, NY.

6. Accent Signage Systems, Minneapolis, MN.

7. The Gruenke Company, Sheboygen Falls, WI.

2.02 FABRICATION

A. Material: Non-glare (matte), UV stable, suitable for interior and exterior use.

1. Substrate Panel: 1/8 inch minimum thick, integrally colored or clear, back foiled and back painted acrylic plastic, or laminated acrylic.

   a) Corners shall be square.

   b) Edges shall be square and eased.

   c) Colors as selected by Architect from manufacturer's custom color range.

2. Characters and Symbols:

   a) Computer cut raised characters and graphics shall be cut from 1/16 inch integrally colored acrylic. Raised characters and graphics shall be inlaid 1/32 inch into first surface of sign background, secured with adhesive so it cannot be removed without the use of tools. Raised characters and graphics shall have beveled, eased or rounded edges. All non-tactile text and graphics shall be applied to the second surface, and background color shall be applied to the second surface and protected with film or an additional backplate.

   b) Pictograms and other symbols including the International Symbol of Accessibility, which are included on signs with raised characters and Braille, are not required to be raised.

   c) Braille characters: Inlaid optically correct acrylic Raster beads into computer drilled holes in the panel surface.

3. Fasteners:

   a) Stainless steel tamper-proof screws and plastic anchors.

   b) Signs mounted on fire-rated doors shall be secured with adhesive.

   c) Adhesives and sealants shall comply with the limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA method 24).

B. Exterior Sign Materials:

1. Sign: 0.080 inch aluminum with rounded corners at least 1/8 inch radius and eased edges. White figure on a blue background; non-glare, high contrast signs. The blue shall be equal to color number 15090 in Federal Standard 595B.

2. Post: 2 by 2 inch galvanized steel tubing, weighing minimum of 4.31 pounds per foot and conforming to ASTM A500, Grade B, 3/16 inch thick wall thickness.

2.03 SIGNS, SYMBOLS AND IDENTIFICATION GENERAL:

A. Finish and Contrast: Characters, symbols and their backgrounds shall have a nonglare finish. Characters and symbols shall contrast with their backgrounds, either light on dark background or dark on light background.

B. Proportions: Characters on signs shall have a width-to-height ratio of between 3:5 and 1:1 and a stroke width-to-height ratio of between 1:5 and 1:10.

C. Character Height: Visual (non-tactile) characters and numbers on signs shall be sized according to the viewing distance which they are going to be read. The minimum height shall be measured using an uppercase X. Lowercase characters are permitted. For signs suspended or projected above the finish floor the minimum character height shall be 3 inches.

1. Lettering Style: Non-decorative non-script fonts. Oblique or italic fonts shall not be used. Use upper and lower case characters, except for headings, emphasis, or regulatory signs that require all uppercase.

D. Raised Characters and Pictorial Symbol Signs: When raised characters are indicated or when pictorial symbols (pictograms) are used on such signs, they shall conform to the following requirements:

1. Character Type: Characters on signs shall be raised 1/32 inch minimum and shall be sans serif uppercase characters accompanied by Grade 2 Braille, per Article 2.03, E.

2. Character Size: Raised characters shall be a minimum of 5/8 inch and a maximum of 2 inches high.

3. Pictorial Symbol Signs (pictograms): Pictorial symbols, other than the International Symbol of Accessibility, shall be accompanied by the verbal description placed directly below the pictogram. The outside dimension of the pictogram field shall be a minimum of 6 inches in height.

4. Character Placement: Characters and Braille shall be in a horizontal format. Braille shall be placed a minimum of 3/8 inch and a maximum of 1/2 inch directly below the tactile characters: flush left or centered. When tactile text is multilined, all Braille shall be placed together below all lines of tactile text.

E. Braille: Only Contracted Grade 2 Braille shall be used. Dots shall be 1/10 inch on centers in each cell with 2/10 inch space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch above background. Braille dots shall be domed or rounded.

F. Mounting Locations and Height: Signs with tactile characters shall be as indicated on the drawings and in conformance to CBC 11B-703.4.

1. Mounting Locations:

a. Identification signs for rooms and spaces shall be located on the wall adjacent to the latch side of the door, as one enters the room or space.

b. Signs that identify exits shall be located at the exit door when approached in the direction of egress travel.

c. Signs containing tactile characters shall be located so that a clear floor space 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.

d. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side.

e. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located at the inactive leaf.

f. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right of the right hand door.

g. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.

2. Mounting height above finish floor or ground: Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters.

G. Symbols of Accessibility: The International Symbol of Accessibility (ISA) shall be the standard used to indentify facilities that are accessible to and usable by physically disabled persons.

1. Color of Symbol: The ISA shall consist of a white figure on a blue background. The blue shall be equal to Color No. 15090 in Federal Standard 595B.

2.04 ROOM IDENTIFICATION SIGNS

A. Room Identification Sign Types:

1. Room Identification Sign with Changeable Insert: 7 inches high by 9 inches wide, minimum, with 4 inches high by 9 inches wide window for name and title removable insert. Locate room name immediately below window, and centered above room number. Room name shall be 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.

2. Room Identification Sign with Room Name and Room Number: 7 inches high by 9 inches wide, minimum. Room name shall be centered above room number. Room name shall be 3/4 inches high minimum, and room number 1 inch minimum; and shall be accompanied with Braille indicators.

3. Room Number Sign: 7 inches wide by 4 inches high; room number, 1 inch high minimum, accompanied by Braille indicator immediately right.

B. Room Identification Symbol for Restrooms: In addition to the room name and Braille indicator, furnish a male, female or all gender symbol, as may be the case.

C. Room Identification Sign Requirements:

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Raised Characters: Refer to Article 2.03, D.

4. Braille: Refer to Article 2.03, E.

5. Mounting Location and Height: Refer to Article 2.03, F.

2.05 TACTILE SIGNS

A. Tactile Exit Sign Types:

1. “EXIT”.

2. “EXIT ROUTE”.

B. Convenience Tactile Signs:

1. “EXIT WITH ALARM”, on exit doors with an alarm.

2. “EXIT ONLY” on exit doors which lock from outside and does not allow a return.

C. Tactile Sign Requirements:

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Raised Characters: Refer to Article 2.03, D.

4. Braille: Refer to Article 2.03, E.

5. Mounting Location and Height: Refer to Article 2.03, F.

2.06 SIGNAGE DIRECTING TO EXIT

A. At exits serving a required accessible space but not providing an approved accessible means of egress, provide signage indicating the location of accessible means of egress.

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Character Height: Refer to Article 2.03, C.

4. Symbol of Accessibility: Refer to Article 2.03, G.

2.07 ASSISTIVE LISTENING DEVICE SIGN

A. Include International Symbol of Access for Hearing Loss with text “Assistive-Listening System Available at XXX”. Use upper and lower case characters. Sign shall comply with the following requirements:

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Character Height: Refer to Article 2.03, C.

4. Symbol of Accessibility: Refer to Article 2.03, G.

2.08 ACCESSIBILITY ENTRANCE SIGNS AND PATH OF TRAVEL DIRECTIONAL SIGNS

A. Entrance Sign: Provide at each building entrance an International Symbol of Accessibility sign. Signs shall be visible to persons along approaching pedestrian ways.

B. Directional Signs: Provide where indicated on the drawings with arrow indicators and International Symbol of Accessibility.

C. Signs shall be mounted on wall with lower edge between 48 inches and 60 inches above ground surface or finish floor. Pole mounted, overhead and projecting signs shall have the lower edge at least 80 inches from the ground surface or finish floor.

D. Sign shall comply with the following requirements.

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Character Height: Refer to Article 2.03, C.

4. Symbol of Accessibility: Refer to Article 2.03, G.

E. No Smoking Sign: Provide at each building entrance. Reverse cut white vinyl sign with 4-1/2 inches high no smoking symbol, mounted on glass entry doors. Under No Smoking symbol, place words “No Smoking”, 1/2 inch high minimum, San Serif upper and lower case characters.

2.10 OCCUPANT LOAD SIGNS

A. Provide maximum occupancy load signs. Post in a conspicuous place near the main exit or exit access doorway from the room or space of rooms and areas indicated in the drawings:

B. Minimum size: 4 inches high by 8 inches wide, 7/8 inch high letters, 1 inch high numerals.

C. Sign to read: “MAXIMUM OCCUPANCY LOAD XXX”. Obtain occupant load information from Architect.

2.11 EMERGENCY GAS-SHUT OFF SIGN

A. Sign: 1/8 inch thick, with text to include: “Emergency gas-shut off valve.”

B. Minimum size: 4 inches high by 8 inches wide, 7/8 inch high letters, 1 inch high numerals.

2.12 FIRE SPRINKLER RISER ROOM SIGN

A. Locate one sign at each fire sprinkler riser room door as indicated in drawings.

B. Text: Sign to read “Fire Sprinkler Riser Inside”, white characters, 1 inch high on red background.

C. Sign Requirements:

1. Proportions: Refer to Article 2.03, B.

2. Raised Characters: Refer to Article 2.03, D.

3. Braille: Refer to Article 2.03, E.

4. Mounting Location and Height: Centered on the door Mounting and 60 inches above the finish floor to the center line of the sign.

2.13 BUILDING NAME

A. Sign, indicating building name, shall be furnished with cast aluminum letters as manufactured by Andco Industries Corp., or equal.

B. Style: Helvetica Medium, Futura 444, Ribbon 555, 556 or 557 as selected.

C. Material: 0.064 inch aluminum construction, unless indicated otherwise.

D. Letter Size: Building name shall be 10 inches high and address shall be 4 inches high, unless indicated otherwise.

E. Letter Copy and Design: As indicated on Drawings.

F. Finish: Finish shall be type H anodic clear or black, as selected by Architect

2.15 EVACUATION PLANS

A. Sign shall consist of a floor plan depicting the building layout. The words “Evacuation Plan” shall be included at the top of the plan in minimum 3/4 inch high characters. Interior spaces shall be indicated by shading and corridor shall be prominent and displayed in white. Sign shall provide emergency procedures information and instructions to be followed in the event of an emergency, and shall be printed with a minimum of 3/16-inch high non-decorative lettering providing a sharp contrast to the background. Emergency procedures information shall include, but not be limited to the following:

1. Viewer location symbol, “You are here” in the plan. Plan shall be oriented in each sign as required to correspond with the users view.

2. Location of exits with arrows leading to them.

3. Stair number and floor number.

4. Location of fire alarm initiating stations and fire extinguishers.

5. What the fire alarm sounds and looks like (audible and visual warning devices).

6. Fire department emergency telephone number 911.

B. Mount signs so that bottom edge is no more than 48 inches from the finish floor, and within close proximity to the building, stair or elevator entrance. The reader must be able to approach the sign without encountering any obstacle.

C. Evacuation Plans Requirements:

1. Finish and Contrast: Refer to Article 2.03, A.

2. Proportions: Refer to Article 2.03, B.

3. Character Height: Refer to Article 2.03, C.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Beginning of installation means installer accepts existing surfaces/

3.02 METHODS OF INSTALLATION

A. Interior Identification Signs and Interior Directional Signs:

1. Fasten to wall with 4 tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.

2. When concealed installation is specified, install backplate to wall as above. Fasten sign to backplate with very high-bond double-faced tape.

3. For installation on glass, fasten sign to glass with very high bond double faced tape. On opposite side of glass, anchor matching backplate to glass with very high-bond double-faced tape.

B. Geometric Signs: Geometric toilet room signs shall be fastened to doors with 3 tamper-proof oval-head counter-sunk screws.

C. Exterior Post Mounted Directional Signs: Install by post mount. Size of required footing shall be as indicated.

D. Exterior Wall Mounted Identification Signs and Directional Signs:

1. Aluminum signs: Fasten to wall with 4 tamper-proof round-head screws, one at each corner of sign. Furnish plastic anchors.

a. Stucco, Brick or Masonry: Provide plastic anchors. For signs greater than 640 square inches use Leadwood Screw Anchors, concrete fasteners 1WSA 10112, or equal.

b. Chain Link Fence: Fasten with 9 gauge hog rings, King Hughes Fasteners 5150DG50, or equal, with 11/16 inch opening at all four corners of sign.

c. Wrought Iron Fence: Install at each corner with 3/16 inch stainless steel rivets.

2. Acrylic signs: Install backplate to wall as above. Fasten sign to backplate with very high-bond double-faced tape and silicone.

E. Exterior Building Sign:

1. Each letter shall be furnished with a minimum of 3 cast mounting lugs on backside, drilled and tapped to receive installation bolts.

2. Letters shall be installed according to manufacturer's method PMC-1. Letters shall be installed 3/4 inch away from wall surface, by an aluminum sleeve spacer.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

3.04 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 10 44 00

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Fire Extinguishers and Cabinets.

C. Related Sections:

1. Section 05 41 00: Structural Metal Stud.

3. Section 09 29 00: Gypsum Board.

1.02 SUBMITTALS

A. Shop Drawings: Indicate materials, sizes, anchorage, and installation details.

B. Product Data: Submit manufacturer's product literature, indicating product characteristics.

C. Material Samples: Submit manufacturer's standard cabinet color Samples for selection by Architect.

1.03 QUALITY ASSURANCE

A. Installer shall be manufacturer trained and certified to install the Work of this section.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's wrapping to protect items.

B. Store items in a dry, enclosed area.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS AND CABINETS

A. Location: Fire extinguisher cabinets and fire extinguishers shall be installed where indicated on Drawings or as required by authorities having jurisdiction.

B. Manufacturer: Fire extinguishers and cabinets shall be manufactured by one of the following:

1. Potter-Roemer

2. J. L. Industries

3. Larsen's Manufacturing

4. Modern Metal Products, by Muckle

5. Waltrous

6. Amerex (fire extinguishers)

C. Fire Extinguisher Type: Provide a legally appropriate rechargeable fire extinguisher for every fire extinguisher cabinet and as otherwise indicated.

1. Special Use Rooms Cabinet mounted:

Type ABC multi-purpose dry chemical with UL rating 2A:10B:C, 5 lb. size, also with red glossy polyester coated steel cylinder, pressure gage, hose and horn. Maximum Height: 15 ¼". Maximum Cylinder Diameter: 4 ½".

D. Fire Extinguisher Requirements:

1. Design Specification:

a. Finish: Corrosion and impact resistant red epoxy.

b. Valve Stem Assembly: Metal, reusable, connects to cylinder by threaded pipefitting, aluminum or steel siphon tube, and shatter resistant plastic face gage.

c. Gage (if applicable) to Indicate: "Recharge," "fully charged (195 PSI)," and "over charge."

d. Pull Pin: Metal, reusable and securely fastened to unit with metal, aluminum chain or very heavy plastic line approximately 4 ½" long.

e. Mechanical Operation: Pistol grip, heavy duty metal handle (plastic not permitted), and shall be operated by a grip and squeeze lever.

2. Manufacturer Identification/Information: Manufacturer's name, date manufactured, model number, U.L. approval seal and/or number, contents operating instructions, Fire Marshall approval, etc. shall be identified on the Fire Extinguisher.

3. Warning and First Aid Label: Fire extinguisher must indicate all standard warnings concerning breathing, eyes, skin and ingestion. Provide emergency and first aid procedures.

4. Property Identification: Label affixed at front of unit, size 2" x 4", shall read "PROPERTY OF GLENDALE UNIFIED SCHOOL DISTRICT".

5. Repair Parts: The manufacturer and/or their representative shall maintain within the Los Angeles Metropolitan Area an adequate stock of replacement parts, available for immediate delivery.

6. Warranty:

a. Manufacturer shall provide a 5 year material warranty.

b. Installer shall provide a 5 year labor warranty.

7. Material Safety Data Sheet: Provide an MSDS sheet with every shipment as set forth in the California Labor Code, Section 6390.

E. Fire Extinguisher Cabinet: Potter-Roemer cabinets are listed as the standard of quality, other manufacturers may be submitted as equal according to Division 01

1. Fully recessed cabinet: Provide fully recessed, square trim edge cabinet with 1/2" projection:

a. Potter-Roemer Fire Extinguisher Cabinet 7020:

1) Door Style: either DVL (Duo Vertical Panel with lock) or E (Center Break Glass with lock), glass to be clear tempered safety glass.

2) Cabinet Door and Frame: Cold rolled steel electrostatically applied, thermally fused polyester coating with recoatable white finish.

3) Identification Lettering: Cabinet door to be furnished with die cut lettering indicating "FIRE EXTINGUISHERS" in contrasting color to cabinet finish, and either vertical or horizontal lettering depending upon door style.

4) Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch. Cabinet and lever shall not project more than 4inches from finish wall.

2. Semi-recessed cabinet: Provide semi-recessed, square trim edge cabinet with 1-1/4"to 2" projection:

a. Potter-Roemer Fire Extinguisher Cabinet 7022:

1) Door Style: either DVL (Duo Vertical Panel with lock) or E (Center Break Glass with lock), glass to be clear tempered safety glass.

2) Cabinet Door and Frame: Cold rolled steel with electrostatically applied, thermally fused polyester coating with re-coatable white finish.

3) Identification Lettering: Cabinet door to be furnished with die cut lettering indicating "FIRE EXTINGUISHERS" in contrasting color to cabinet finish, and either vertical or horizontal lettering depending upon door style.

4) Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch. Cabinet and lever shall not project more than 4inches from finish wall.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with manufacturer's recommendations.

B. Cabinets shall be installed plumb and level, where indicated on Drawings, at heights required by authorities having jurisdiction.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off Project site.

END OF SECTION

SECTION 10 5613

STEEL STORAGE ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Steel shelving units.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 05 5000 - Metal Fabrications.

3. Section 06 4000 - Architectural Woodwork.

1.02 PROJECT REQUIREMENTS

A. Steel Shelving: Shelving racks, single- or double-faced units, at least 85 inches high, unless otherwise indicated, of lengths and depths indicated.

1. Backs, intermediate uprights, and ends of units shall be closed or open as indicated; except that double faced units shall be furnished with closed ends.

2. Module sizes: 24-inch, 30-inch, 36-inch, 42-inch and 48-inch wide; 12-inch, 18-inch, 24-inch, 30-inch and 36-inch deep as indicated.

B. Metal Finish:

1. Metal components, except aluminum and plated parts, shall be furnished with a phosphatized baked enamel factory finish installed in two coats with 0.001 inch minimum dry film thickness. Finish coat shall be smooth, free of streaks, drops, sags, pinholes, checks, cracks, peeling, blisters, and foreign material.

2. Bolts, nuts, and clips shall be zinc-plated.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data for special construction and non-standard shelving required.

1.04 QUALITY ASSURANCE

A. Qualifications of Installer: Shelving shall be installed by a firm having at least five years experience in installations of comparable scope and complexity.

PART 2 - PRODUCTS

2.01 COMPONENTS

A. Shelves:

1. Shelves shall be 18 gage commercial quality, cold rolled steel and formed on four sides into a channel shape, reinforced full length, front and rear, with a 1 inch by 1 inch by 1/8 inch angle or a 1 inch by 12 gage bar or shelf shall be 22 gage with 1 3/16-inch by 13/16 inch minimum box flanges, front and back, and with lapped and welded corners. Edges shall be ground smooth, free from barbs and sharp edges.

2. Shelves shall be reversible and interchangeable. Top and bottom shelves shall be bolted to each post.

3. Each intermediate shelf shall be fastened with four one-piece clips, of a type that can be repositioned without the use of tools or special adapter and without disturbing shelving in adjoining sections.

4. Exposed faces of shelves shall be furnished with continuous label holders, 7/8 inch minimum in height and fabricated from 24 gage steel. Fasten to shelf with three bolts.

B. Posts:

1. Posts shall be formed of roll-formed angle shape or tubular, 1 ¾-inch, at least 13 gage, with holes punched as required, maximum 2 inches on center.

2. Brace each intermediate upright and alternate backs with at least one pair of one inch by 12 gage cross bracing. Omit at sections with closed ends, backs or intermediate uprights.

3. Double entry racks shall be furnished with eight corner gussets of 14 gage steel instead of cross- bracing at front or back. Each gusset shall be bolted to post with two bolts measuring 1/4 inch in diameter and to shelf with one ¼ inch diameter bolt.

C. Bases: Provide a 3-inch by 20 gage steel closed base strip to top surface of bottom shelf.

D. End and Back Panels: Panels for closed ends and backs shall be 24 gage steel, 22 gage where exposed.

PART 3 - EXECUTION

3.01 ERECTION

A. Steel shelving shall be installed plumb and level. Install over zinc-plated floor plate, 13 gage minimum, installed under upright posts.

B. Anchoring: Steel shelving shall be fastened to floor and walls.

1. Floor: Freestanding racks shall be fastened to floor at each exposed end and at intermediate uprights at 9 feet on center maximum. Furnish 1 ½-inch by 11/16 inch hold-down angles, 14 gage minimum perforated for two fasteners as near upright as possible.

2. Walls: Fasten shelving to walls through rear shelf flange at each end and alternate section, at top shelf and at second shelf from bottom. Omit floor anchoring.

3. Fasteners:

   a. Concrete: 5/16 inch diameter, 1 ½-inch minimum penetration, and self-drilling concrete anchors.

   b. Wood: 1/4 inch minimum diameter plated lag screw with 1 ½-inch minimum penetration into wood.

3.02 ADJUSTING

A. Install and securely tighten fasteners.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

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SECTION 12 24 13

ROLLER SHADE SYSTEM

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Provide manually operated, sunscreen and blackout roller shades as applicable.
B. Motor-operated roller shades for skylights

C. Related Sections:
1. Division 08 – Doors & Windows
2. Division 09 - Gypsum Board Assemblies: Coordination with gypsum board assemblies for blocking, installation of shade pockets, closures and related accessories.
3. Division 09 - Acoustical Ceilings: Coordination with acoustical ceiling systems for blocking, installation of closures and related accessories.
4. Division 26 - Electrical

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
3. Storage and handling requirements and recommendations.
4. Mounting details and installation methods.

B. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, and relationship to adjacent work.
1. Prepare shop drawings on AutoCAD or BIM format using base sheets provided electronically by the Architect.

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

D. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.

E. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

F. Warranty: Provide manufacturer's warranty documents as specified in this Section.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Obtain roller shades system through one source from a single manufacturer with a minimum of ten years experience and minimum of five projects of similar scope and size in manufacturing products comparable to those specified in this section. This includes but is not limited to all required extrusions, accessories, controls and fabricated roller shades or else all stated and published warranties may be void.

B. Installer Qualifications: Engage an installer, which shall assume responsibility for installation of all system components, with the following qualifications.

1. Installer for roller shade system shall be trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.

C. Fire-Test-Response Characteristics: Passes NFPA 701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

D. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

E. PVC-Free Shadecloth: Comply with the following.
1. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.
2. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.
3. Recycling Characteristics: Provide documentation that the shade cloth can, and is part of a closed loop of perpetual use and not be required to be down cycled, incinerated or otherwise thrown away. Scrap material can be sent back to the mill for reprocessing and recycling into the same quality yarn and woven into new material, without down cycling. Certify that this process is currently underway and will be utilized for this project.
4. Perpetual Use Certification: Certify that at the end of the useful life of the shade cloth, that the material can be sent back to the manufacturer for recapture as part of a closed loop of perpetual use and that the material can and will be reconstituted into new yarn, for weaving into new shade cloth. Provide information on each shade band indicating that the shade band can be sent back to the manufacturer for this purpose.
5. Roller shade hardware, shade fabric, EDU, and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

F. Mock-Up: Provide a mock-up, if Architect requires, of one roller shade assembly for evaluation of mounting, appearance and accessories.
1. Locate mock-up in window designated by Architect.
2. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:
1. Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

2. Roller Shade Installation: One year from date of Substantial Completion, not including scaffolding, lifts or other means to access to the work above 12' Feet AFF, which are the responsibility of others.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. Basis of Design Manufacturer for Window Shade System: Products by MechoSystems; 42-03 35th Street, Long Island City, NY 11101. Tel: (718) 729-2020 ext 1901; Mr. Glen Berman. Email: glenb@MechoSystems.com.
B. Skyco http://www.skycoshade.com
C. Draper http://www.draperinc.com/WindowShades/index.asp
D. Or Approved Equal.

2.2 SHADE BANDS

A. Shade Bands: Construction of shade band includes the fabric, the enclosed hem weight, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable.
   1. Concealed Hembar: Shall be continuous extruded aluminum for entire width of shade band and with the following characteristics:
      a. Hembar shall be heat sealed on all sides.
      b. Open ends shall not be accepted.
   2. Shade Band and Shade Roller Attachment:
      a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection.
      b. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
      c. Mounting Spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
      d. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets, does not meet the performance requirements of this specification and shall not be accepted.

2.3 ROLLER SHADE FABRICATION

A. Fabricate shade cloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth 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.
B. Provide battens in standard shades as required to assure proper tracking and uniform rolling of the shade bands. 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 shadecloth within specified standards. Battens shall be roll-formed stainless steel or tempered steel, as required.

C. Blackout shade bands, when used in side channels, shall have horizontally mounted, roll-formed stainless steel or tempered-steel battens not more than 3 feet (115 mm) on center extending fully into the side channels. Battens shall be concealed in an integrally colored fabric to match the inside and outside colors of the shade band, in accordance with manufacturer's published standards for spacing and requirements.
   1. Battens shall be roll formed of stainless steel or tempered steel and concave to match the contour of the roller tube.

2.4 ROLLER SHADE COMPONENTS

A. Access and Material Requirements:
   1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
   2. Provide shade hardware that allows for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
   3. Use only Delran engineered plastics by DuPont for all plastic components of shade hardware. Styrene based plastics, and /or polyester, or reinforced polyester shall not be accepted.

B. Manual Operated Chain Drive Hardware and Brackets:
   1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for all shade drive end brackets. Universal offset shall be adjustable for future change.
   2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
   3. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
   4. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable.
   5. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
   6. Drive Bracket / Brake Assembly:
      a. MechoShade Drive Bracket model M5 shall be fully integrated with all MechoShade accessories, including, but not limited to: SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
      b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
      c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
      d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
      e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.
   7. Drive Chain: #10 qualified stainless-steel chain rated to 90 lb. (41 kg) minimum breaking strength. Nickel plate chain shall not be accepted. Bottom of drive chain shall be within 48 inches from finish floor.

2.5 MOTOR-OPERATED, SKYLIGHT ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

   1. System Type: Single-motor, double-roller system, with motor in drive roller and spring in take-up roller.

2. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

3. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

   Electrical Characteristics: 110-V ac.
   Maximum Total Shade Width: As required to operate roller shades indicated.
   Maximum Shade Length: As required to operate roller shades indicated.
   Maximum Weight Capacity: As required to operate roller shades indicated.

4. Remote Control: Keyed control station.
   Limit Switches: Adjustable switches, interlocked with motor controls and set to stop shade movement automatically at fully raised and fully lowered positions.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

   Drive-End Location: Right side of interior face of shade.
   Direction of Shadeband Roll: Regular, from back (exterior face) of roller**.**

C. Shadeband Retention System: Manufacturer's standard system for guiding shadeband through range of travel and holding shadeband taut with edges of shadeband supported by side channels or angles. Mounting Hardware: Corrosion resistant and compatible with operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Shadebands: Shadeband Material: Light-blocking fabric.
   Shadeband Bottom (Hem) Bar: Manufacturer's standard for operating mechanism indicated. Color and Finish of Exposed Bottom Bar: As selected by Architect from manufacturer's full range.

E. Installation Accessories:
   Channels or Angles: Manufacturer's standard design for operating mechanism indicated and shadeband take-up and support. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.6 ROLLER SHADE SCHEDULE

A. Roller Shade Schedule: Refer to the Drawings for locations.

1. Shade Type WT-1: Manual independently operating interior, chain drive room darkening blackout roller shades with blackout fabric in all exterior windows of rooms and spaces, with all related mounting systems and accessories.
   a. Fascia.

2. Shade Type WT-2: Manual operating interior, chain drive room roller shades with 3 percent open fabric in all exterior windows of rooms and spaces, with all related mounting systems and accessories.

2.7 SHADECLOTH

A. Room Darkening (PVC Free) Shadecloth with Opaque Acrylic Backing: MechoSystems, “Equinox 0100 series”, .008 inches thick (.19 mm) blackout material and weighing .94 lbs. per square yard, comprising of 53% fiberglass, 45% acrylic, 2% poly finish. Blackout shaded to be 0-1% open.
   1. Color: Selected from manufacturer’s standard colors.

B. Visually Transparent Single-Fabric Shadecloth: MechoSystems, ThermoVeil® group, single thickness, opaque non-raveling 0.030-inch (0.762 mm) thick vinyl fabric, woven from 0.018-inch (0.457 mm) diameter extruded vinyl yarn comprising of 21 percent polyester and 79 percent reinforced vinyl, in colors selected from manufacturer's available range.
   1. Open Linear Weave: "1800 series", 3 percent open, linear-weave pattern. VLT_range _5__to_10__percent.

2.8 ROLLER SHADE ACCESSORIES

A. Fascia:
   1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
   2. Fascia shall be able to be installed across two or more shade bands in one piece.
   3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
   4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION OF ROLLER SHADES

A. Contractor Furnish and Install Responsibilities:
   1. Window Covering Contractor (WC) shall provide an on site, Project Manager, and shall be present for all related jobsite scheduling meetings.
   2. WC shall supervise the roller shade installation, and setting of intermediate stops of all shades to assure the alignment of the shade bands within a single EDU group, which shall not exceed +/- 0.125 inches (3.175mm), and to assure the alignment between EDU groups, which shall not exceed +/- 0.25 inches (6.35mm).
   3. WC shall be responsible for field inspection on an area-by- area and floor-by-floor basis during construction to confirm proper mounting conditions per approved shop drawings.
   4. Verification of Conditions: examine the areas to receive the work and the conditions under which the work would be performed and notify General Contractor and Owner of conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected. Commencement of installation shall constitute acceptance of substrate conditions by the installer.
   5. WC shall provide accurate to 0.0625 inch (1.5875mm); field measurements for custom shade fabrication on the Roller Shades manufacturers input forms.
   6. WC Installer shall install roller shades level, plumb, square, and true according to manufacturer's written instructions, and as specified here in. Blocking for roller shades installed under the contract of the interior General Contractor shall be installed plumb, level, and fitted to window mullion as per interior architect's design documents and in accordance with industry standard tolerances. The horizontal surface of the shade pocket shall not be out-of-level more than 0.625 inch (15.875mm) over 20 linear feet (6.096 meters)
   7. Shades shall be located so the shade band is not closer than 2 inches (50 mm) to the interior face of the glass. Allow proper clearances for window operation hardware.
   8. Adjust, align and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

9. Installer shall set Upper, Lower and up to 3 intermediate stop positions of all motorized shade bands, and assure alignment in accordance with the above requirements.
10. WC shall certify the operation of all motorized shades and turn over each floor for preliminary acceptance.
11. The WC shall participate and cooperate with the electrical contractor, the window shade manufacturer and the Commissioning agent to verify and certify the installation is in full conformance with the specifications and is fully operational. This work to occur during the commissioning stage and is in addition to preliminary acceptance required for each floor.
12. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
13. WC shall train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.
14. Protect installed products until completion of project.
15. Touch-up, repair or replace damaged products before Substantial Completion.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1) Submittal scheduling 01 32 00

2) Submittal Procedures 01 33 00

3) Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4) Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5) Drawings and Specifications

The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.

2. Sleeves.

3. Escutcheons.

4. Grout.

5. Painting and finishing.

6. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.

2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel".

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications".

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping".

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames".

PART 2 - PRODUCTS

2.1 ORIGIN OF PRODUCTS

A. Automatic Fire Suppression System including all piping and appurtenances, shall be manufactured in the USA, unless noted otherwise.

2.2 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.3 PIPE, TUBE, AND FITTINGS

A. Refer to Division 21 13 13 Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.4 JOINING MATERIALS

A. Refer to Division 21 13 13 Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

   a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

   b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers

   a. Advance Products & Systems, Inc.

   b. Calpico, Inc.

   c. Metraflex Co.

   d. Pipeline Seal and Insulator, Inc.

   e. Approved Equal.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

B. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.7 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated, rough brass, or matte.

C. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge set screw.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.

3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

f. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

g. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

O. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials

a. Steel Pipe Sleeves: For pipes smaller than NPS 6.

b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting".

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.6 GROUTING

A. Mix and install grout for fire-suppression equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION

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SECTION 21 13 13

WET PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.
“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications

The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. Section Includes

1. Pipes, fittings, and specialties.

2. Fire-protection valves.

3. Sprinklers.

4. Pressure gages.

B. Related Sections

1. Division 33 Section "Water Utilities".

2. Division 28 Section "Fire Detection and Alarm".

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

B. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

A. Dry-Pipe Sprinkler System: Automatic sprinklers are attached to dry piping that is connected to water supply through a dry pipe valve. Water discharges once the water reaches the sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device.

B. Double-Interlock Preaction Sprinkler System: Automatic sprinklers are attached to piping containing compressed air. Actuation of a fire detection system in the same area as sprinklers and loss of air pressure release a closed solenoid valve that opens the deluge valve permitting water to flow into the sprinkler piping; then water will discharge from sprinklers that have opened.

C. System to provide coverage for all buildings.

D. Provide hydraulically designed system to meet the occupancy requirements outlined by the California Building Code, California Fire Code and NFPA 13.

E. Interface system with building control system and the building fire and smoke alarm system.

F. Provide and install control valves, check valves, flow switches, tamper devices, local alarms and inspector test valves.

G. Provide personnel and material to perform all acceptance tests and to assist in inspections.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.

2. Pipe hangers and supports including seismic restraints.

3. Valves, including listed fire-protection valves and specialty valves and trim.

4. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.

5. Water flow switch and tamper switch, including electrical data.

6. Alarm devices, including electrical data.

7. Submit performance ratings, rough-in details, weights, support requirements, and piping connections

B. Shop Drawings:

1. Upon completion of the work, the Contractor shall provide reproducible As-Built Drawings to the Architect. Final approvals are subject to receipt of acceptable As-Built Drawings.

C. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved

1. Domestic water piping.

2. Items penetrating finished ceiling include the following:

a. Lighting fixtures.

b. Air outlets and inlets.

D. Qualification Data: For qualified Installer.

E. Submittals having any content which is incomplete or unclear will be returned without review or approval.

F. Discharge patterns and application data shall be included in submittals for sidewall, water curtain, and similar special purpose sprinklers.

G. Operating Instructions: Provide instruction charts describing operation and proper maintenance of system equipment.

H. Welding certificates.

I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

J. Field quality-control reports.

K. Samples: Submit two of each style of sprinkler specified.

L. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications

a. Installing Contractor shall have a C-16 license.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. The Contractor shall coordinate work specified in other Divisions to avoid any interference with the effectiveness of the fire protection system. Shop drawings shall include elevations of equipment and piping specified in other Divisions to assure coordination. The fire protection system shall be coordinated with work specified in other Divisions to assure that conflicts will not arise with structural, mechanical, electrical or architectural features of the building. Any changes required by field coordination, even after the approved shop drawings, shall be provided and installed at no cost to the Owner.

C. The Contractor shall coordinate the fire sprinkler and alarm work to ensure full awareness of the location of all control valves, flow switches, tamper switches, and alarm and signal switches

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 ORIGIN OF PRODUCTS

A. Automatic Fire Suppression System including all piping and appurtenances, shall be manufactured in the USA, unless noted otherwise.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

2.3 STEEL PIPE AND FITTINGS

A. Schedule 40, Black-Steel Pipe: ASTM A 53/A 53M. Pipe ends may be factory or field formed to match joining method.

B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, Schedule 40, seamless steel pipe with threaded ends.

C. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

D. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

E. Grooved-Joint, Steel-Pipe Appurtenances

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Victaulic Company.

b. Anvil International Inc.

c. Approved Equal.

2. Pressure Rating: 250 psig minimum.

3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

F. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements.

a. Victaulic Company.

b. Anvil International Inc.

c. Approved Equal.

2.4 SEISMIC EXPANSION JOINTS

A. All sprinkler pipe passing through or crossing building seismic joints, shall contain a flexible expansion loop, designed for seismic movement. Flexible loops shall impart no thrust loads to building structure. Loops shall be located at, or near, the building seismic joint. 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 +-4” movement

in the ±X, ±Y, ±Z planes. Flexible loops may be installed to accommodate thermal expansion, seismic movement, and building settlement. Unless specified otherwise by system design engineer or governing codes, all flexible loop connections to sprinkler piping shall be installed, inspected, and tested in accordance with current NFPA-13 standards.

B. Flexible loops shall consist of two flexible sections of hose and braid, two 90 degree elbows, and 180 degree return. Loops shall include a factory supplied, center support nut located at the bottom of the 180 degree return, and a drain/air release plug. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection. It shall be UL listed for Fire Sprinkler application.

C. Manufacturer:

1. Metraflex.

2. Approved Equal.

2.5 LISTED FIRE-PROTECTION VALVES

A. General Requirements

1. Valves shall be UL listed or FM approved.

2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

a. Anvil International, Inc.

b. Victaulic Company.

c. NIBCO.

d. Approved Equal.

2. Standard: UL 1091 except with ball instead of disc.

3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.

4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.

5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Check Valves

1. Manufacturers: Subject to compliance with requirements, provide or comparable product by one of the following:

a. Anvil International, Inc.

b. Victaulic Company.

c. NIBCO.

d. Approved Equal.

2. Standard: UL 312.

3. Pressure Rating: 250 psig minimum.

4. Type: Swing check.

5. Body Material: Cast iron.

6. End Connections: Flanged or grooved.

D. OS & Y Gate Valves

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

a. Kennedy

b. NIBCO INC.

c. Tyco Fire & Building Products LP.

d. Victaulic Company.

e. Approved Equal.

2. Standard: UL 262.

3. Pressure Rating: 175 psig minimum.

4. Valves NPS 2-1/2" and Larger.

a. Valve Type: OS&Y.

b. Body Material: Cast or Ductile Iron.

c. End Connections: Flanged.

5. Valve Operation: Integral electrical, 115-V AC, prewired, single-circuit, supervisory switch indicating device.

E. Indicating-Type Butterfly Valves

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

a. Kennedy

b. NIBCO INC.

c. Tyco Fire & Building Products LP.

d. Victaulic Company.

e. Approved Equal.

2. Standard: UL 1091.

3. Pressure Rating: 175 psig minimum.

4. Valves NPS 2 and Smaller

a. Valve Type: Butterfly.

b. Body Material: Bronze.

c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger

a. Valve Type: Butterfly.

b. Body Material: Cast or ductile iron.

c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral [electrical, 115-V AC, prewired, single-circuit, supervisory switch indicating device.

2.6 UNLISTED GENERAL-DUTY VALVES

A. Ball Valves NPS 2 and smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig (4140-kPa) minimum CWP rating, blowout-proof stem, and threaded ends.

B. Check Valves NPS 2 and smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.

C. Gate Valves NPS 2 and smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.

D. Globe Valves NPS 2 and smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.7 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed. If drilling of the system riser is necessary to mount flow switch, the drilled out disc shall be retrieved and attached to the mounting u-bolt of the flow switch. The vane type flow switch shall be equipped with an adjustable delay of audible alarm initiation. Adjustment range shall be from 0 to 120 seconds.

1. Manufacturers: Subject to compliance with requirements, provide products by pone of the following;

a. Grinnell Fire Protection.

b. Potter Electric Signal Company.

c. Viking Corp.

d. Approved Equal.

C. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.

1. Manufacturers: Subject to compliance with requirements, provide products by pone of the following;

a. McWane, Inc.; Kennedy Valve Div.

b. Potter Electric Signal Company.

c. System Sensor.

d. Approved Equal.

2.8 PRESSURE GAUGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMETEK; U.S. Gauge Division

b. Ashcroft, Inc.

c. Brecco Corporation.

d. WIKA Instrument Corporation.

e. Approved Equal.

2.9 SPRINKLER SPECIALTY PIPE FITTINGS

A. Sprinkler Inspector's Test Fittings

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Tyco Fire & Building Products LP.

b. Victaulic Company.

c. Viking Corporation.

d. Approved Equal.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide", published by FM Global, listing.

3. Pressure Rating: 175 psig minimum.

4. Body Material: Cast- or ductile-iron housing with sight glass.

5. Size: Same as connected piping.

6. Inlet and Outlet: Threaded.

2.10 SPRINKLERS

A. Manufacturers: Basis of design is Viking Corporation or provide comparable product by one of the following manufacturers:

1. Reliable Automatic Sprinkler Co., Inc.

2. Grinnell Fire Protection.

3. Victaulic Company.

4. Approved Equal

B. General Requirements

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide", published by FM Global, listing.

2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element

1. Nonresidential Applications: UL 199

2. Characteristics: Quick Response with nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler types, features and options as follows.

1. Quick Response Sprinklers:

a. Concealed ceiling sprinklers including cover plate: Viking SIN VK300

b. Pendent on drop sprinklers: Viking SIN VK302

c. Recessed sidewall sprinklers including escutcheon plate: Viking SIN VK305

d. Upright sprinklers: Viking SIN VK 462

e. Upright large orifice sprinklers: Viking SIN VK 350.

E. Sprinkler Finishes

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

2. Upright and Pendent on drop sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

F. Sprinkler Guards

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Reliable Automatic Sprinkler Co., Inc.

b. Tyco Fire & Building Products LP.

c. Victaulic Company.

d. Viking Corporation.

e. Approved Equal.

2. Standard: UL 199.

3. Type: Wire cage with fastening device for attaching to sprinkler.

2.11 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following

1. AMETEK; U.S. Gauge Division.

2. Ashcroft, Inc.

3. Brecco Corporation.

4. WIKA Instrument Corporation.

5. Approved Equal.

B. Standard: UL 393.

C. Dial Size: to 4-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Water System Piping Gage: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 PIPING APPLICATIONS, GENERAL

A. Shop weld pipe joints where welded piping is indicated.

B. Do not use welded joints for galvanized-steel pipe.

C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.

D. Underground Service-Entrance Piping: Ductile-iron, push-on-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.

3.4 SPRINKLER SYSTEM PIPING APPLICATIONS

A. Standard-Pressure, Wet-Pipe Sprinkler System, 175-psig Maximum Working Pressure:

1. NPS 1-1/2 and smaller: Threaded-end, black, Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

2. NPS 2: Threaded-end, black, Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

3. NPS 2-1/2 to NPS 3: Threaded-end, black, Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

4. NPS 2-1/2 to NPS 3: Plain-end, black, Schedule 40 steel pipe; steel welding fittings; and welded joints.

5. NPS 4: Threaded-end, black, black or galvanized, Schedule 40 steel pipe; cast- or malleable-iron threaded fittings; and threaded joints.

6. NPS 4: Plain-end, black, Schedule 40 steel pipe; steel welding fittings; and welded joints.

3.5 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Listed Fire-Protection Valves: UL listed and FMG approved for applications where required by NFPA 13.

a. Shutoff Duty: Use ball, butterfly, or gate valves.

2. Unlisted General-Duty Valves: For applications where UL-listed and FMG-approved valves are not required by NFPA 13.

a. Shutoff Duty: Use ball, butterfly, or gate valves.

b. Throttling Duty: Use ball or globe valves.

3.6 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

M. Fill sprinkler system piping with water.

3.7 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows

1. Apply appropriate tape or thread compound to external pipe threads.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.8 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression piping to water-service piping of size and in location indicated for service entrance to building. Refer to Division 22 Section "Facility Water Distribution Piping" for exterior piping.

B. Install shutoff valve, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.9 WATER-SUPPLY CONNECTION

A. Connect water-supply piping to fire-suppression piping. Above ground piping to be flushed and tested prior to connection to underground service piping.

3.10 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

3.11 SPRINKLER APPLICATIONS

A. Rooms without Ceilings: Upright Sprinklers or Pendent sprinklers, as indicated.

B. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers, as indicated.

C. Wall Mounting: Sidewall sprinklers.

D. Sprinkler Finishes:

1. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

2. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.

3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.

3.12 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

3.13 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

3.14 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Connect water-supply piping to fire-suppression piping. Refer to Division 22 Section "Domestic Water Piping Specialties" for backflow preventers.

D. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

E. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.

F. Electrical Connections: Power wiring is specified in Division 26.

G. Connect alarm devices to fire alarm.

H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems".

I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

J. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.15 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems".

3.16 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

4. Energize circuits to electrical equipment and devices.

5. Coordinate with fire-alarm tests. Operate as required.

6. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.17 CLEANING AND PROTECTION

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

C. Protect sprinklers from damage until substantial completion.

3.18 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.19 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section for Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish piping with temporary inlet and outlet caps until installation.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications

The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.

2. Transition fittings.

3. Dielectric fittings.

4. Mechanical sleeve seals.

5. Sleeves.

6. Escutcheons.

7. Equipment installation requirements common to equipment sections.

8. Painting and finishing.

9. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. PE: Polyethylene plastic.

2. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.

2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.

2. Dielectric fittings.

3. Mechanical sleeve seals.

4. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. PVC Piping: ASTM D 2564. Include Primer according to ASTM F 656

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Manufacturers:

a. Cascade Waterworks Mfg. Co.

b. Dresser Industries, Inc.; DMD Div.

c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.

d. JCM Industries.

e. Smith-Blair, Inc.

f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.

3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.

4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Manufacturers:

a. Thompson Plastics, Inc.

D. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Manufacturers:

a. Calder

b. Cascade Waterworkd Mfg. Co.

c. Fernco, Inc.

d. Mission Rubber Company

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Eclipse, Inc.

d. Epco Sales, Inc.

e. Hart Industries, International, Inc.

f. Watts Industries, Inc.; Water Products Div.

g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1. Manufacturers:

a. Capitol Manufacturing Co.

b. Central Plastics Company.

c. Epco Sales, Inc.

d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Central Plastics Company.

d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Calpico, Inc.

b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Manufacturers:

a. Perfection Corp.

b. Precision Plumbing Products, Inc.

c. Sioux Chief Manufacturing Co., Inc.

d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Manufacturers:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.

F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

G. One-Piece, Floor-Plate Type: Cast-iron floor plate.

H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c. Insulated Piping: One-piece, stamped-steel type with spring clips.

d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.

f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.

g. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with exposed-rivet hinge and set screw.

h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.

i. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw or spring clips].

j. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

3. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation. For soundproof walls provide ¾-inch annular clear space. Use the following sleeve materials:

a. PVC Schedule 40 Pipe Sleeves: For foundation walls.

b. 24 Gauge Galvanized sheet metal assemblies with telescopic sleeves and square base plates: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c. Walls and Floors: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.

2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

3. PVC Nonpressure Piping: Join according to ASTM D 2855.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.

2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.3 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 22 05 03

EARTHWORK FOR PLUMBING SYSTEMS

PART1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes limited scope instructions for methods and materials applicable to excavation for underground utilities and services, including underground piping under the building and from building to utility connection, tanks, basins, and equipment.

1.02 SUBMITTALS

A. Submit schedules in accordance with Conditions of Contract and Divisions 01 and 22 specification sections.
   1. Indicate proposed methods and schedule of operations prior to commencement of work.
   2. Include coordination for shut off of utility services where required.
   3. Maintain services to areas outside construction limits, where such service exists.
   4. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 01.

1.03 DEFINITIONS

A. Excavation consists of removal of material encountered to sub-grade elevations indicated and subsequent disposal of materials removed.

B. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.

C. Sub-grade: The undisturbed earth or the compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

D. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

1.04 CODES AND ORDINANCES

A. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

1.05 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:
   1. Maintain and protect existing building services which transit the area affected by selective demolition.
   2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.

B. Site Information: Subsurface conditions were investigated during the design of the Project.

Reports of these investigations are available for information only; data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions drawn from this information.

C. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Remove existing underground utilities indicated to be removed.

D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility
companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

E. Use of Explosives: Use of explosives is not permitted.

1.06 SEQUENCE AND SCHEDULING

A. Coordinate the shut off and disconnection of utility services with Owner and utility company.

B. Provide minimum of 48-hour written notice to Architect and Owner, and receive written

approval confirmation, prior to any necessary utility interruption.

PART 2 PRODUCTS

2.01 MATERIALS

A. Select Bedding Sand: Dry river bed sand free of any debris or organic matter.

B. Mastic Coatings: "Henry's" oil base roof mastic.

C. Polyethylene sheeting not less than 8 mils thick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas where earthwork is to occur. Determine extent of work and effect on existing conditions to remain. Advise Architect of any conditions that might create extensive alteration beyond indicated scope.

B. Clearances: Take special notice and maintain the required horizontal and vertical depth clearances from structural footings for utility trenches running parallel to footings. Do not violate the area of the footing bearing prism. In the event of conflict (i.e., the utility cannot be relocated or its depth changed), proceed as directed by the Architect. Lower structural footings to maintain proper clearances for underground utilities trenching without additional cost to Owner.

3.02 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
   1. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

3.03 DEWATERING

A. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
   1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
   2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

3.04 MATERIAL STORAGE

A. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.

   1. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
   2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

3.05 TRENCHING

A. Do all necessary trenching, excavation, shoring and backfilling required for the proper laying of the pipe lines.

B. Pipe Trench Dimensions: The following requirements are considered minimal unless otherwise indicated, in order to provide adequate pipe clearances and bedding. Provide trenches wider than the specified minimum where required to properly install the particular type of piping. In the event utility company regulations, code requirements, or the pipe manufacturer's recommendations differ from these provisions, the most restrictive requirements shall take precedence:
   1. Pipe Burial Depths:

Sewer & Drainage:	24"(a) + pipe O.D.(b) + 3" bed of sand
Gas:	30" + pipe O.D. + 4" bed of sand
Water (Domestic)	
PVC:	30" + pipe O.D. + 4" bed of sand
All other:	24" (30" at planters)+ pipe O.D. + 4" bed of sand
Pre-insulated Piping	24" + jacket O.D. + 4" bed
Condenser Water (PVC)	30" + pipe O.D. + 4" bed

      Notes:
      a. Finish grade to top of pipe, typical. b. O.D.: Outside dimension.
   2. Trench Widths:

Sewer & Drainage: pipe	12" + pipe O.D. for 4" to 18" diameter
Gas:	8" + pipe O.D.
Water (Domestic)	8" + pipe O.D.
Water (Fire)	
Pre-insulated Pipe	8" + jacket O.D.
Condenser Water	8" + pipe O.D.

C. Where rock is encountered, carry excavation below required elevation and backfill with a layer of select bedding sand prior to installation of pipe. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and pipe.

D. Excavate trenches for piping and equipment with bottoms of trench to accurate elevations for support of pipe and equipment on undisturbed soil.

E. Do not install copper piping or metal gas piping in a common trench with other dissimilar metal piping or conduit; separate a minimum of 4 feet when running parallel to such piping or conduit.

F. Separate multiple parallel lines of piping in a common trench a minimum of 12 inches, both horizontally and vertically, between individual pipes.

G. Install domestic water piping, running parallel in a common trench with sewer or drainage lines, on a solid shelf 12 inches above the sewer or drainage piping.

H. Do not run electrical power and communications conduit in a common trench with sewer, drainage, water or gas piping.

I. Provide and install a bare 14 gauge copper "tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure to piping at alternate joints, at each fitting and at each valve. Locate "Tracer" wire along side pipe, but not under pipe.

J. Install thrust blocks in all pressurized lines. Install thrust blocks in accordance with pipe manufacturer's recommendations.

3.06 EXCAVATION FOR UNDERGROUND CLARIFIERS AND STRUCTURES

A. Excavation for Underground Tanks, Basins, and Mechanical Structures: conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction,
and for inspection.
   1. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter larger with emulsified asphalt tree paint.
   2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

3.07 BACKFILLING AND FILLING

A. Backfilling and Filling: Place soil materials in layers to required sub-grade elevations for each area classification listed below, using materials specified in Part 2 of this Section.

B. Bedding: Lay and bed pipe in compacted select dry river-bed bedding sand, thickness as specified herein and backfill with the same sand material to a height of one foot above the top of pipe.
   1. Sewer drain lines except as hereinafter specified may be bedded in the native soil provided it is rock free and sandy. Dig out under bell portions of the piping for uniform bearing.
   2. Under walks and pavements, use a combination of sub-base materials and excavated or borrowed materials.
   3. Under building slabs, set piping on a 6-inch bed of dry river-bed sand and backfilled to 12" of finish grade with dry river-bed sand. Remainder of backfill to be approved backfill material.

4. Under piping and equipment, use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.
5. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a 4-inch thick concrete encasement (sides and top) prior to backfilling and placement of roadway sub-base.
6. Other areas, use excavated or borrowed materials.

C. Backfill excavations as promptly as work permits, but not until completion of the following:
1. Do not backfill until installation has been approved and as-built drawings are up to date.
2. Inspection, testing, approval, and locations of underground utilities have been recorded.
3. Removal of concrete formwork.
4. Removal of shoring and bracing, and backfilling of voids.
5. Removal of trash and debris.

D. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage as specified in Division 02. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

F. Place backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.

G. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg. F.

H. Unauthorized excavation:
1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

3.08 SUBSIDENCE

A. Subsidence: Where subsidence occurs at mechanical installation excavations during the period

12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.09 CORROSION PROTECTION

A. All below ground metallic fittings, valves, flanges, bolts, pipes (which are not factory coated with a bituminous material) shall be protected against corrosion as follows:
   1. All metallic components as described above shall receive a heavy coating of "Henry's" oil base roof mastic.
   2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 8 mil polyethylene wrap overlapped 50% of the circumference and extended beyond ends of component as required for polyethylene to be secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends and seam of the polyethylene material shall be secured to the piping and sealed with 3M Scotch/Wrap N. 50, 10 mil., 2" wide, printed, pipe wrap sealing tape.
   3. The mastic coating shall be inspected and approved prior to the finish application of the polyethylene material, which shall also be inspected.

END OF
SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 35 00

2. Submittal content and format 01 35 00

3. Substitutions 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications: The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. Section Includes:

1. Gages.

2. Test plugs.

B. Related Sections:

1. Division 22 Section "Facility Water Distribution Piping" for domestic and fire-protection water service meters outside the building.

2. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.

3. Division 23 Section "Facility Natural-Gas Piping" for gas meters.

4. Division 33 Water Utility Metering.

1.3 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated; include performance curves.

B. Product Certificates: For each type of thermometer and gage, signed by product manufacturer.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.

2. Ernst Gage Co.

3. Trerice, H. O. Co.

4. Weiss Instruments, Inc.

5. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.

C. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.

1. Case: Liquid-filled type, drawn steel or cast aluminum, 4-1/2-inch diameter.

2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.

3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.

4. Movement: Mechanical, with link to pressure element and connection to pointer.

5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.

6. Pointer: Red metal.

7. Window: Glass or plastic.

8. Ring: Stainless steel.

9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.

10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure.

11. Range for Fluids under Pressure: Two times operating pressure.

D. Pressure-Gage Fittings:

1. Valves: NPS 1/4 brass or stainless-steel needle type.

2. Snubbers: ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

PART 3 - EXECUTION

3.1 GAGE APPLICATIONS

A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.

B. Install liquid-filled-case-type pressure gages at suction and discharge of each pump.

3.2 INSTALLATIONS

A. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.

B. Install remote-mounting pressure gages on panel.

C. Install needle-valve and snubber fitting in piping for each pressure gage.

D. Install test plugs in tees in piping.

E. Install permanent indicators on walls or brackets in accessible and readable positions.

F. Install connection fittings for attachment to portable indicators in accessible locations.

G. Install thermometers and gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.

H. Adjust faces of thermometers and gages to proper angle for best visibility.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications: The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. Section Includes:

1. Bronze ball valves.

2. Bronze swing check valves.

3. Bronze gate valves.

4. Iron Gate valves.

5. Bronze globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.

2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. C.W.P: Cold Working Pressure

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

E. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.

2. Protect threads, flange faces, grooves, and weld ends.

3. Set gate, and globe valves closed to prevent rattling.

4. Set ball valves open to minimize exposure of functional surfaces.

5. Block checks valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Gate Valves: With rising stem.

2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.

2. Solder Joint: With sockets according to ASME B16.18.

3. Threaded: With threads according to ASME B1.20.1.

F. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. NIBCO INC.

b. Apollo

c. Hammond Valve.

d. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.

b. SWP Rating: 150 psig.

c. CWP Rating: 600 psig.

d. Body Design: Two piece.

e. Body Material: Bronze.

f. Ends: Threaded or Soldered.

g. Seats: PTFE or TFE.

h. Stem: Bronze.

i. Ball: Chrome-plated brass.

j. Port: Full.

2.3 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.

b. Milwaukee Valve Company.

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 3.

b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded.

f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.

b. Milwaukee Valve Company.

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 4.

b. CWP Rating: 200 psig.

c. Body Design: Horizontal flow.

d. Body Material: ASTM B 62, bronze.

e. Ends: Threaded.

f. Disc: PTFE or TFE.

2.4 BRONZE GATE VALVES

A. Class 125, NRS Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.

b. Milwaukee Valve Company.

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem: Bronze.

f. Disc: Solid wedge; bronze.

g. Packing: Asbestos free.

h. Handwheel: Malleable iron or bronze.

2.5 IRON GATE VALVES

A. Class 125, NRS, Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.

b. Milwaukee Valve Company.

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-70, Type I.

b. CWP Rating: 200 psig.

c. Body Material: ASTM A 126, gray iron with bolted bonnet.

d. Ends: Flanged.

e. Trim: Bronze.

f. Disc: Solid wedge.

g. Packing and Gasket: Asbestos free.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Stockham Division.

b. Milwaukee Valve Company.

c. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 1.

b. CWP Rating: 200 psig.

c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.

d. Ends: Threaded or solder joint.

e. Stem and Disc: Bronze.

f. Packing: Asbestos free.

g. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install chainwheels on operators for ball, gate and globe valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.

F. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

2. Center-Guided and Plate-Type Check Valves: In horizontal or vertical position, between flanges.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball, or gate valves.

2. Throttling Service: Globe or ball valves.

3. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with bronze discs.

b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, metal or resilient-seat check valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

4. For Steel Piping, NPS 2 and Smaller: Threaded ends.

5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.

2. Class 125, Class 150, bronze disc.

3. Ball Valves: Two piece, full port,bronze trim.

4. Bronze Swing Check Valves: Class 150, bronze disc.

5. Bronze Gate Valves: Class 125, NRS.

6. Bronze Globe Valves: Class 125 bronze discs.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Iron Ball Valves: Class 150.

3. Iron Swing Check Valves: Class 250, nonmetallic-to-metal seats.

4. Iron Gate Valves: Class 125, NRS.

5. Iron Globe Valves: Class 125.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.

2. Trapeze pipe hangers.

3. Metal framing systems.

4. Thermal-hanger shield inserts.

5. Fastener systems.

6. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.

3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.

2. Thermal-hanger shield inserts.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. Hubbard Enterprices/HOLDRITE®
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Co.
4. PHD Manufacturing, Inc.
5. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

1. The total weight of piping and components upon each trapeze span shall not exceed the manufactures load rating. Load ratings must included a minimum 2 X safety factor.

a. Hubbard Enterprices/HOLDRITE EZ-Strut™ or owner approved equivalent.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Tolco Inc.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Hubbard Enterprices/HOLDRITE®
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.

4. Pipe Shields, Inc.

C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder – Actuated Fasteners Shall Not Be Used

B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hubbard Enterprices/HOLDRITE®

b. B-Line Systems, Inc.; a division of Cooper Industries.

c. Hilti, Inc.

d. ITW Ramset/Red Head.

e. Powers Fasteners.

2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Plenum Rated Pipe Clamps: ASTM E-84 25/50 plastic clamps from Hubbard Enterprises/HOLDRITE.

C. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

D. Roof top supports: Roof top support application for hydronic piping, domestic hot and cold water piping, condensate piping and natural gas piping as manufactured by Cooper B-Line.

1. Description: UV resistant 100% recycled rubber base, channels, channel nuts, pipe straps/clamps, rollers and roller support; assembly shall be compatible with strut systems.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Support of pipe, tubing and equipment shall be accomplished by means of engineered products, specific to each application. Makeshift, field devised methods shall not be allowed.

F. Use padded hangers for piping that is subject to scratching.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 .

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

3. For vertical mid-span support of piping 4” and under, use Hubbard Enterprises/HOLDRITE Stout Brakets™ with Hubbard Enterprises/HOLDRITE Stout Clamps or two-hole pipe clamps (MSS Type 26).

I. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

J. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5. C-Clamps (MSS Type 23): For structural shapes.

6. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

7. Overhead pipe runs of 1" and less to utilize Hubbard Enterprises/HOLDRITE #125, #125-L or #121 Series brackets.

K. Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

2. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

L. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

M. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

N. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use mechanical-expansion anchors instead of building attachments where required in concrete construction. Power-actuated fasteners are prohibited, unless approved in writing by the Architects and the Structural Engineer.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers. For piping 2" and below, manufactured specialty products formed from pregalvanized commercial steel are to be used, such as the Hubbard Enterprises/HOLDRITE EZ-Strut.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2. Field fabricates from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2'/2" and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

M. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b. NPS 4: 12 inches long and 0.06 inch thick.

5. Insert Material: Length at least as long as protective shield.

6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

N. Roof top supports: Dura-Blok products as manufactured by Copper B-Line.

1. Support bases only.

2. Support base with 14 gauge B44 channel.

3. Support base with 12 gauge B12 channel.

4. Support base with 12 gauge B22 channel.

5. Dura-Blok bases shall be attached to roof with Henry 204 non-hardening, non-running plastic roof cement. No nail, screws and bolts shall be used to penetrate the finished roof.

3.3 EQUIPMENT SUPPORTS

A. Engineered, Factory-fabricated, galvanized steel supports are to be used when suspending equipment from overhead structures or when supporting equipment above the floor.

1. Suspended water heater installations shall include a drain pan with minimum 2-1/2" high sidewalls and a minimum ¾" drain connection.

2. Water heaters of 50 gallons or less, suspended from the structure above, shall be installed with an engineered and manufactured product like the Suspended Water Heater Platform with integral drain body from Hubbard Enterprises/HOLDRITE or Owner-approved equivalent.

3. Water heaters placed on a stand, to elevate them above the floor, shall be installed using a manufactured galvanized steel stand, engineered to meet the intended weight load. Use the QuickStand series from Hubbard Enterprises/HOLDRITE.

4. Water heaters installed in seismic zones shall be supported from the adjoining structure by the use of DSA approved safety restrain devises. Use QuickStarp from Hubbard Enterprises/HOLDRITE or Owner-approved equivalent.

B. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

C. Grouting: Place grout under supports for equipment and make smooth bearing surface.

D. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

2. Warning signs and labels.

3. Pipe labels.

4. Stencils.

5. Valve tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4. Fasteners: Stainless-steel rivets or self-tapping screws.

5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2. Letter Color: White.

3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7. Fasteners: Stainless-steel rivets or self-tapping screws.

8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving,1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches (38 mm) high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum intervals of [50 feet (15 m)] <Insert dimension> along each run. Reduce intervals to [25 feet (7.6 m)] <Insert dimension> in areas of congested piping and equipment.

7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Domestic Water Piping:

a. Background Color: Green.

b. Letter Color: Black.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Green.

b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

a. Cold Water: 2 inches, round.

b. Hot Water: 2 inches, round.

2. Valve-Tag Color:

a. Cold Water: Green.

b. Hot Water: Green.

3. Letter Color:

a. Cold Water: White.

b. Hot Water: White.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1. Submittal scheduling 01 32 00

2. Submittal Procedures 01 33 00

3. Substitution Procedures 01 25 00

Should the Contractor desire to substitute any material, equipment or other items for those specified, he shall submit a complete list, including detailed equipment layouts. Any changes required by the furnishing and installation of substituted material, equipment and other item shall be arranged for and paid for by the contractor; any expense incurred is part of this contract.

4. Equivalent Equipment 01 25 00

In addition to detailed specifications of materials and equipment, the specifications make reference to “substitutions” which is not to be, construed as equivalent.

“Equivalent equipment” will be considered as complying with the contract documents if the quality, features, performance, physical shape and appearance of the “equivalent equipment” are in the Architect’s opinion the same or similar to those of the material and equipment described in detailed specifications.

5. Drawings and Specifications The drawings and specifications are deemed to be complementary. In case of discrepancy or overlapping conflicting requirements between the drawings and the specifications, the contractor shall provide the more expensive alternate unless he has obtained a written clarification prior to bid opening. Anything shown on the drawings and not mentioned in the specifications, and not shown on the drawings, shall be deemed to have mentioned in both. Should the material and equipment shown on the drawings not be specified by name, model number and description, the contractor shall provide such material and equipment in accordance with the Architect’s selection unless he has obtained a written clarification prior to bid opening.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Flexible elastomeric.

b. Mineral fiber.

2. Insulating cements.

3. Adhesives.

4. Mastics.

5. Sealants.

6. Factory-applied jackets.

7. Field-applied fabric-reinforcing mesh.

8. Field-applied jackets.

9. Tapes.

10. Securements.

11. Corner angles.

B. Related Sections include the following:

1. Division 21 Section "Fire-Suppression Systems Insulation."

2. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets both factory and field applied.

B. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following, but are not limited to, the following:

a. Aeroflex USA Inc.; Aerocel.

b. Armacell LLC; AP Armaflex.

c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

d. Or approved equal.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following, but are not limited to, the following]:

a. Johns Manville; Micro-Lok.

b. Knauf Insulation; 1000(Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

d. Or approved equal.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal

density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. CertainTeed Corp.; CrimpWrap.

   b. Johns Manville; MicroFlex.

   c. Knauf Insulation; Pipe and Tank Insulation.

   d. Owens Corning; Fiberglas Pipe and Tank Insulation.

   e. Or approved equal.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Insulco, Division of MFS, Inc.; SmoothKote.

   b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.

   c. Rock Wool Manufacturing Company; Delta One Shot.

   d. Or approved equal.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to it and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Products, Division of ITW; CP-96.

   b. Foster Products Corporation, H. B. Fuller Company; 81-33.

   c. Or approved equal.

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Aeroflex USA Inc.; Aeroseal.

b. Armacell LCC; 520 Adhesive.

c. Foster Products Corporation, H. B. Fuller Company; 85-75.

d. RBX Corporation; Rubatex Contact Adhesive.

e. Or approved equal.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Or approved equal.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following]:

a. Dow Chemical Company (The); 739, Dow Silicone.

b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

c. P.I.C. Plastics, Inc.; Welding Adhesive.

d. Red Devil, Inc.; Celulon Ultra Clear.

e. Speedline Corporation; Speedline Vinyl Adhesive.

f. Or approved equal.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide the following provide one of the following:

a. Childers Products, Division of ITW; CP-35.

b. Foster Products Corporation, H. B. Fuller Company; 30-90.

c. ITW TACC, Division of Illinois Tool Works; CB-50.

d. Marathon Industries, Inc.; 590.

e. Or approved equal.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-10.

b. Foster Products Corporation, H. B. Fuller Company; 35-00.

c. ITW TACC, Division of Illinois Tool Works; CB-05/15.

d. Marathon Industries, Inc.; 550.

e. Or approved equal.

2. Water-Vapor Permeance: ASTM F 1249, 3 perms at 0.0625-inch dry film thickness.

3. Service Temperature Range: Minus 20 to plus 200 deg F.

4. Solids Content: 63 percent by volume and 73 percent by weight.

5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.

b. Foster Products Corporation, H. B. Fuller Company; 30-45.

c. Marathon Industries, Inc.; 405.

d. Or approved equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Permanently flexible, elastomeric sealant.

4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).

5. Color: White or gray.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Products, Division of ITW; CP-76.

b. Or approved equal.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and

with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2) Or approved equal.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Johns Manville; Zeston.

b. P.I.C. Plastics, Inc.; FG Series.

c. Proto PVC Corporation; LoSmoke.

d. Speedline Corporation; SmokeSafe.

e. Or approved equal.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

b. Compac Corp.; 104 and 105.

c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

e. Or approved equal.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.

b. Compac Corp.; 130.

c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.

d. Venture Tape; 1506 CW NS.

e. Or approved equal.

2. Width: 2 inches.

3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch wide, stainless steel or Monel.

B. Wire: 0.062-inch soft-annealed, stainless steel soft-annealed, galvanized steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire.

   b. Childers Products.

   c. PABCO Metals Corporation.

   d. RPR Products, Inc.

   e. Or approved equal.

2.10 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Manholes.

5. Handholes.

6. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.

3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.

4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.

4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.

3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Provide PVC jackets on all exposed piping insulation and in equipment rooms and where indicated on the drawings. Install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.8 FINISHES

A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect field-insulated equipment, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.

2. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded

valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.

2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:
   1. Division 22 Section 22 05 00 applies to the work of this Section.
   2. Piping materials and installation methods peculiar to individual systems are specified within their respective system specification sections of Division 02 and 22.
   3. Valves are specified in a separate section and in individual piping system sections of Division 22.
   4. Expansion Compensation is specified within the respective system specification section of Division 22.
   5. Division 22 05 29 "Hangers and supports".
   6. Division 22 05 53 "Plumbing Identification".

1.02 SECTION INCLUDES

A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes joining materials, fire stop sealants, and basic piping installation instructions.

1.03 SUBMITTALS

A. Refer to Division 01 and Section 22 05 00 for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on fire stop sealants.

1.04 QUALITY ASSURANCE

A. Welding procedures and testing shall comply with ANSI Standard B31.1.0- Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

B. Soldering and brazing procedures shall conform to ANSI 89.1 Standard Safety Code for Mechanical Refrigeration.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Refer to the individual piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

B. Weld-0-Lets: Welding Weld-0-Lets may be used in lieu of tees where branch connection pipe size is two or more pipe sizes smaller than main header size.

2.02 JOINING MATERIAL

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

D. Soldering materials shall not contain lead.

E. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

F. All pipe shall be reamed to the full I.D. of the pipe/tube and remove all burrs before joining.

2.03 SLEEVES AND SEALS

A. Sleeves:
1. Sheet-Metal Sleeves: 5" and Smaller, 20 gage galvanized sheet metal; 6" and Larger, 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
3. Galvanized steel telescoping type: Galvanized sheet metal per manufacturer's standards.
4. Polyethylene Sleeves: Manufacturer's standard product.

B. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.04 FIRESTOP SEALANT

A. Fire stopping material shall be asbestos-free and capable of maintaining an effective barrier against flame and gases in compliance with the following requirements:
1. Flame Spread: 25 or less, ASTM E 84.
2. Smoke Development: 50 or less, ASTM E 84.
3. Combustibility: Noncombustible; ASTM E 136.

B. Material when installed shall have the same fire rating as the assembly in which it is being installed.

2.05 PIPING ISOLATION

A. Manufacturer's standard product for providing sound and electrolysis isolation.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream ends of pipes and tubes, and remove all burrs, to full I.D. of the pipe/tube. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other

design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.

B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

E. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals.

I. Coordinate to provide curb, minimum 4" above finish floor, for all pipe shafts or floor openings for multiple pipes.

J. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

3.03 PIPE SUPPORTS AND HANGERS

A. Horizontal Pipes: Hangers and supports shall be hung from solid rods, and lengths of which shall be adjustable. Strap hangers will not be permitted. In lieu of individual hangers, trapeze hangers may be used for parallel pipes, details of which shall be submitted to the Architect for approval. Hanger rods for both single and trapeze hangers shall be hung from suitable clips, beam clamps or inserts, as necessary. For concrete construction, inserts shall be set in forms before concrete is poured. Explosive type fasteners or studs will not be permitted. "Phillips" type shield may be used when authorized by the Architect. No piping shall be supported by any wire, rope, wood or other makeshift device.

B. Provide hangers size and spacing per SMACNA "Guidelines for Seismic Restraint of Mechanical Systems".

C. Where building construction does not permit the above-specified spacing of hangers, the Contractor shall provide adequate additional steel supports. Location and details shall be submitted to the Architect for approval. In all cases, pipe supports shall be spaced to provide adequate support for the pipes, the medium in the pipes, insulation, valves and fittings.

D. All vertical pipelines shall be supported, not hung, at each floor. Malleable iron or steel pipe clamps of ample size, bolted around the pipes, shall be used for these pipe supports. All vertical water piping shall have vibration isolators between support clamp and structure.

E. Pipe hangers shall be of the positive restraint type or be provided with approved restraint clips to prevent lateral movement of attachment.

F. Pipe hangers shall be of the positive restraint type or be provided with approved restraint clips to prevent lateral movement of attachment.

G. Contractor may refer to details applicable in the SMACNA "Guidelines for Seismic Restraint of Mechanical Systems".

3.04 FITTINGS AND SPECIALTIES

A. Use fittings for all changes in direction and all branch connections.

B. Remake leaking joints using new materials.

C. Install Y-type strainers with blow-down valves on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

D. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air).

G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

3.05 JOINTS

A. Steel Pipe Joints:
   1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten to leave not more than 3 threads exposed.
   2. Pipe Larger than 2":
      a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
      b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
      c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

B. Non-ferrous Pipe Joints:
   1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 -Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.
   2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using every fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
   3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

C. Joints for other piping materials are specified within the respective piping systems sections.

3.06 INSTALLATION OF SLEEVES

A. Provide pipe sleeves for pipes to pass through walls, floor and roofs. Diameter of sleeve to be 1-inch larger than the outside diameter of pipe or pipe and covering of insulated pipe. Galvanized steel telescoping type sleeves or polyethylene may be used. Where seepage may occur, use steel pipe sleeves.

B. All pipe sleeves through floors other than floors on grade shall extend 2-inches above finished floor and shall be caulked with mineral wool. Provide collar where polyethylene sleeve is used.

C. Where required in existing construction, or where sleeves have been omitted, openings for pipe may be core drilled in floors and/or walls or partitions, providing prior acceptance of such core drilling is obtained from the Architect. Holes core drilled through floors above grade shall be provided with sleeves extending 2-inches above finish floor as hereinbefore specified.

D. Seal with resilient sealant: Dow Corning "Fire Stop" or approved equal.

3.07 INSTALLATION OF FIRE STOP SEALANT

A. Fire-stopping shall be provided at, but not limited to, duct, and piping penetrations through floor slabs and through time rated partitions or firewalls.

B. Install fire-stopping materials in accordance with the manufacturer's instructions and the following requirements.

C. Filling: Fire-stopping materials shall completely fill the void spaces.

D. Coordination: Coordinate the work with other trades. Fire-stopping materials at penetrations of insulated pipes and ducts shall be applied prior to insulation, unless the insulation meets the requirements specified for fire-stopping.

E. Surface Preparation: Surfaces to be in contact with fire-stopping materials shall be free of dirt, grease, oil, loose material, rust, or other substances that may affect proper fitting or the required fire resistance.

3.08 INSTALLATION OF PIPE ISOLATION

A. Provide sound and electrolysis isolation on all un-insulated, pipes, Semco "Trisolators" or Potter-Roamer "Prisolators".

3.09 INSTALLATION OF PIPE FLASHING

A. Pipe flashing assemblies, "Semco" Fig. 1100-4, as required, seal the joint between flashing and pipe with waterproofing compound. Install counter-flashing sleeve to cover a minimum of 3/4-inch to top of lead flashing, making the top joint permanently watertight.

3.10 TESTING OF PIPING

A. Provide notification of test at least three working days prior to tests on all or part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed.

B. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system, which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue after full test pressure is achieved.

C. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges, threaded joints and all welds shall be left unpainted and un-insulated until the piping systems have been approved.

D. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.

E. Equipment such as pumps, chillers, tanks, heat exchangers, flexible hose, safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.

F. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.

G. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.

H. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.

I. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.

J. Do not apply test pressure until the piping system and its contents approach the same temperature.

K. While piping is under test, exercise care, that excessive pressure does not occur due to increase in ambient temperature.

L. Control Valves:
   1. Control valves which are installed with block and by-pass valve shall have the block valve closed, the by-pass valve opened, and a temporary pipe piece inserted in place of the control valve (or a test blank may be installed on each side of the control valve) until all flushing and testing of all lines of that system is completed and accepted by the Owner, after which they shall be reinstalled.
   2. Control valves installed without 'block or by-pass valves shall be replaced by a pipe piece during flushing and testing of the system. After acceptance of the flushing they shall be reinstalled.

M. Minimum piping test pressures shall be as noted in tabulation; or they shall be 150 percent of design pressure for the specific system being tested, whichever is higher.

SYSTEM	TEST MEDIUM	TESTING PRESSURE (PSIG)	DURATION (HOURS)	ACCEPTABLE TOLERANCE
Soil, Water, Vent, & Storm Water	Water	Top of highest vent	4	No joint sweat
Water	Water	150	4	None. Except temperature change.
Fuel Gas	Air	60	4	None. Except temperature change.
Fire Sprinkler	Water	200	4	None. Except temperature change.

N. Conduct hydrostatic tests with water at a temperature below 100 degrees F.
   1. Fill the system slowly with water and vent at highest points to expel the air before pressurizing.
   2. Carefully examine all joints for leaks or defects.
   3. Provide connections as required to accomplish the above.

O. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:

1. Identification of piping system and test number.
2. Testing medium.
3. Test pressure.
4. Date of test acceptance.

3.11 ADJUSTMENTS

A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

END OF SECTION

SECTION 22 10 19

PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 RELATED SECTIONS

A. This section applies to all piping systems specified in Division 22.

B. Valves are specified in a separate section and in individual piping system sections of Division 22.

C. Fire Barrier Penetration Seals are specified in Section 22 10 00.ade

1.2 SECTION INCLUDES

A. This Section specifies piping specialties and installation methods common to more than one section of Division 22.

1.3 SUBMITTALS

A. Refer to Division 01 and Basic Mechanical Requirements for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on the following items:
   1. Escutcheons
   2. Dielectric Unions and Fittings
   3. Mechanical Sleeve Seals
   4. Strainers

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or, by packaging with durable, waterproof wrapping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer Uniformity: Conform to the requirements specified in Basic Mechanical Requirements, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:
   1. Pipe Escutcheons:
      a. Chicago Specialty Mfg. Co.
      b. Grinnell
      c. Seaton-Cadwell
   2. Dielectric Waterway Fittings:
      a. Epco Sales, Inc.
      b. Victaulic Company of America
   3. Dielectric Unions:
      a. Eclipse, Inc.
      b. Perfection Corp.
      c. Watts Regulator Co.
   4. Strainers:
      a. Armstrong Machine Works
      b. Hoffman Specialty ITT; Fluid Handling Div.
      c. Metraflex Co.
      d. R-P&C Valve; Div. White Consolidated Industries, Inc.
      e. Spirax Sarco

f. Trane Co.
g. Victaulic Co. of America. (Low pressure applications only).
h. Watts Regulator Co.

5. Mechanical Sleeve Seals:
   a. Thunderline Corp.

2.2 PIPE AND FITTINGS

A. Refer to the individual piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

2.3 JOINING MATERIALS

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.4 PIPING SPECIALTIES

A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

D. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.
   1. Provide strainers with 125 psi working pressure rating for low-pressure applications, and 250 psi pressure rating for high-pressure application.
   2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blow-down fitted with pipe plug.
   3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   5. Butt Welded Ends, 2-1/2" and Larger for Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   6. Butt Welded Ends, 2-1/2" and Larger for High Pressure Application: Schedule 80 cast carbon

steel body, bolted screen retainer with off-center blow-down fitted with pipe plug.

7. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 EXECUTION

3.1 ESCUTCHEONS

A. Install escutcheons at all exposed penetrations of piping through walls, ceilings, and floors in rooms with finish surfaces.

3.2 FITTINGS AND SPECIALTIES

A. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

B. Install unions adjacent to each valve and at the finc:il connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

C. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

D. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).

E. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

END OF SECTION

SECTION 22 11 00

FACILITY WATER DISTRIBUTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section includes potable cold water, hot water, and circulation hot water piping, fittings, and specialties within the building to a point of 5 feet outside the building.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section.
   1. Division 33 section 33 10 00 "Water Distribution System" for water service piping (which connects the "Water Distribution Piping" to wells and public utilities).
   2. Division 7 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through basement walls and fire and smoke barriers.
   3. Division 22 Section "Valves."
   4. Division 22 Section "Meters and Gages" for thermometers and pressure gages.
   5. Division 22 Section "Plumbing Identification" for labeling and identification of piping systems.
   6. Division 22 Section "Plumbing Pumps" for circulators, circulation pumps, motors, and accessories.
   7. Division 22 Section "Common Work Result for Plumbing."

B. Separate sections of Division 22 specify Basic Piping Materials and Methods, Hangers, and Supports, Expansion Compensation, piping system identification, materials and requirements, general duty valves, pipe insulation, fire protection piping, and plumbing equipment.

1.03 DEFINITIONS

A. Water Distribution Pipe: A pipe within the building or on the premises that conveys water from the water service pipe or meter to the points of usage.

B. Water Service Pipe: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

C. Pipe sizes used in this Specification are nominal pipe size (NPS).

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.
   1. Product data for each piping specialty and valve specified.
   2. Test reports specified in Part 3 of this Section.
   3. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual specified in Division 01 and Division 22 Section- "Common Work Results for Plumbing."

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following codes:
   1. ASME B31.9 "Building Services Piping" for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.

2. Comply with applicable portions of Codes and Regulations in use by Authorities having jurisdiction. (See Division 22 Section "Common Work Results for Plumbing").

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings and specialties, from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

D. Store CPVC, and PVC pipe and fittings where protected from direct sunlight.

E. Store pipe in a manner to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.08 EXTRA MATERIALS

A. Maintenance Stock: Furnish one valve key for each key-operated wall hydrant, hose bibb, fixture supply, or faucet installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Uniformity: Conform to the requirements specified in Division 22 section "Common Work Results for Plumbing."

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Strainers:
      a. Josam Co.
      b. Metraflex Co.
      c. Smith (Jay R.) Mfg. Co.
      d. Spirax Sarco, Inc.
   2. Balance Cocks:
      a. Hammond Valve Corp.
      b. Milwaukee Valve Co., Inc.
      c. Walworth
      d. Stockham Valves & Fittings, Inc.
   3. Hose Bibbs:
      a. Lee Brass Co.
      b. Nibco, Inc.
      c. Watts Regulator Co.
      d. Woodford Mfg. Co.
   4. Wall Hydrants:

a. Josam Co.
b. Smith (Jay R.) Mfg. Co.
c. Wade Div., Tyler Pipe
d. Woodford Mfg. Co.
e. Zurn Industries Inc., Hydromechanics Div.

5. Backflow Preventers:
   a. Cla-Val Co.
   b. Febco
   c. Hersey Products, Inc.
   d. Watts Regulator Co.
   e. Zurn Industries Inc. Wilkins Regulators Div.
6. Pressure-Regulating Valves:
   a. Cash (A.W.) Valve Mfg. Corp.
   b. Cla-Val Co.
   c. Spence Engineering Co., Inc.
   d. Watts Regulator Co.
   e. Zurn Industries, Inc., Wilkins Regulator Div.
7. Relief Valves:
   a. Cash (A. W.) Valve Mfg. Corp.
   b. Watts Regulator Co.
   c. Zurn Industries, Inc. Wilkins Regulator Divs.
8. Water Hammer Arresters:
   a. Amtrol, Inc.
   b. Ancon, Inc.
   c. Josam Co.
   d. Precision Plumbing Products, Inc.
   e. Smith (Jay R.) Mfg. Co.
   f. Wade Div., Tyler Pipe
   g. Watts Regulator Co.
   h. Zurn Industries, Inc.; Hydromechanics Div.
9. Mechanical Couplings and Fittings for Grooved-End Steel Pipe:
   a. Grinnell Corp.
   b. Gustin-Bacon Div., Tyler Pipe
   c. Stockham Valves & Fittings, Inc.
   d. Victaulic Co. of America
10. Mechanical Couplings and Fittings for Grooved-End Copper Tube:
    a. Victaulic Co. of America
11. Compression Fittings for PB Plastic Pipe:
    a. Brass-Craft Sub. of Masco Corp.
12. Vacuum Breakers for Hose Connections:
    a. Cash (A.W.) Valve Mfg. Corp.
    b. Conbraco Industries, Inc.
    c. Watts Regulator Co.
13. Mechanical Sleeve Seals:
    d. Thunderline Corp.
14. Pipe Escutcheons:
    a. Chicago Specialty Mfg. Co.
    b. Sanitary-Dash Mfg. Co.
    c. Grinnell
15. Dielectric Waterway Fittings:

a. Epco Sales, Inc.
b. Victaulic Company of America

16. Dielectric Unions:
    a. Eclipse, Inc.
    b. Perfection Corp.
    c. Watts Regulator Co.

2.02 PIPE AND TUBE MATERIALS, GENERAL

A. Pipe and Tube: Refer to Part 3, Article "Application, General," for identification of systems where the below materials are used.

B. Copper Tube: (Within Building) ASTM B88, Type 'L' Water Tube, drawn temper.

C. Copper Tube: (Underground) ASTM B88, Type 'K' Water Tube, annealed temper.

2.03 FITTINGS

A. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined patter.

B. Wrought Copper and Bronze Grooved-End Fittings: ASTM B75 Tube and ASTM B584 Bronze Castings.

C. Unions: ASME B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces, female threaded ends. Threads shall conform to ASME B1.20.1.

D. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion.

E. Dielectric Unions: Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze wire reinforced protective jacket; minimum 150 psig working pressure, maximum 250 degree F operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be 12" long and capable of 3/4-inch misalignment. Sweat ends are not acceptable.

2.04 JOINING MATERIALS

A. Solder Filler Metal: ASTM B32, 95-5 Tin-Antimony.

B. Brazing Filler Metals: AWS A5.8, BCUP Series.

C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and design temperatures and pressure.

2.05 GENERAL-DUTY VALVES

A. General-duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 22 Section "Valves." Special duty valves are specified below by their generic name; refer to Part 3 Article "Valve Application" for specific uses and applications for each valve specified.

B. Shut-off valves in PVC Pipe: Ball type valve with union ends rated for 150 PSI W.P. and suitable for distilled water service.

2.06 SPECIAL DUTY VALVES

A. Balance Cocks: 400 PSI WOG, 2 piece, ball valve, handle, memory stop, with threaded-end connections conforming to ASME B1.20.1.

B. Balance Cocks: 400 PSI WOG, 2 piece bronze, ball valve, handle, memory stop, with solder-

end connections.

2.07 PIPING SPECIALTIES

A. Water Hammer Arresters: Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 shall be of the following sizes unless otherwise indicated on the drawings:

1. Self-closing valves, lavatories, sinks, etc.

Supply or header pipe size	W.H.A. No.
1/2"	5005
3/4"	5005
1"	5010

2. Flushometer, automatic and solenoid valves:

Supply or header pipe size
3/4"
1"
1-1/4"
1-1/2"
2"

B. Basket Strainers: Cast-iron body, 125 psi flanges, bolted-type or yoke-type cover with removable non-corrosive perforated strainer basket having 1/8-inch perforations and lift-out handle.

C. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch. Strainers in copper lined to have bronze bodies.
   1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
   2. Threaded ends, 2" and Smaller: Cast-iron body, or bronze body, screwed screen retainer with centered blow-down fitted with pipe plug.
   3. Threaded Ends, 2-1/2" and Larger: Cast-iron body or bronze body bolted screen retainer with off-center blow-down fitted with pipe plug.
   4. Flanged Ends, 2-1/2" and Larger: Cast-iron body or bronze body, bolted screen retainer with off-center blow-down fitted with pipe plug.

D. Hose connections: Hose connections shall have garden hose threaded outlets conforming to ASME B1.20.7.

E. Exposed Hose Bibbs: Bronze body with chrome- or nickel-plated finish, with renewable composition disc, wheel handle, 1/2- or 3/4- inch solder inlet, hose outlet. Exposed hose bibs are to project at maximum 4".

F. Recessed Wall Hydrants: Cast-bronze box and door, with chrome-plated face, tee handle key, vacuum breaker, hinged locking cover, 3/4-inch inlet, and hose outlet. Bronze casing shall be length to suit wall thickness.

G. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.

H. Backflow Preventers: Reduced-pressure-principle assembly consisting of shutoff valves on inlet and outlet and strainer on inlet. Assemblies shall include test cocks and pressure-differential relief valve located between 2 positive seating check valves and comply with requirements of ASSE Standard 1013. Assemblies shall have approval of Health Department having jurisdiction.

I. Pressure-Regulating Valves: Single-seated, direct-operated type, having bronze body with integral strainer and complying with requirements of ASSE Standard 1003. Select proper size for maximum flow rate and inlet and outlet pressures indicated.

J. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.
   1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Temperature relief valves shall be factory set at 210 degree F, and pressure relief at 150 psi.

K. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation.

L. Sleeves:
   1. Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

M. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts

and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine rough-in requirements for plumbing fixtures and other equipment with water connections to verify actual locations of piping connections prior to installation.

3.02 PREPARATION

A. Ream ends of pipes and tubes, and remove burrs to full inside diameter within the pipe/tube. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.03 PIPE APPLICATIONS

A. Install Type L, drawn copper tube with wrought copper fittings and solder joints for pipe sizes 4 inches and smaller, above ground, within building.

B. Install Type K, annealed temper copper tube for pipe sizes 2 inches and smaller, with minimum number of joints, below ground.

C. Water piping in sizes 2-1/2 to 6 inches may be Type L drawn copper tube with roll-grooved ends and mechanical couplings, above ground within building.

3.04 PIPING INSTALLATION

A. General Locations and Arrangements; Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

B. Contractor shall provide protection for all metallic piping below grade as outlined in the installation standards for protectively coated pipe (IAPMO IS 13-91) due to soil's high rate of corrosivety.

C. Use fittings for all changes in direction and branch connections.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.

E. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

F. Conceal all piping installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

G. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

H. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

I. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.

J. Pipe sleeves smaller than 6 inches shall be galvanized steel pipe; pipe sleeves 6 inches and larger shall be galvanized steel sheet metal.

K. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls with sleeves and mechanical sleeve seals.

L. Fire Barrier Penetrations: Where pipes pass though fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity. Refer to Division 7 for special sealers and materials.

M. Paint all black piping above ground that is exposed to elements of moisture, condensation, rain, or sunlight. Reference Section 09 90 00 Paint.

3.05 HANGERS AND SUPPORTS

A. General: Hanger, support, and anchor devices conforming to MSS SP-69 are specified in Division 22 Section, "Hangers and Supports." Conform to the table below for maximum spacing of supports:

B. Pipe Attachments: Install the following:
1. Adjustable steel clevis hangers, MSS Type 1, for individual horizontal runs less than 20 feet in length.
2. Adjustable roller hangers, MSS Type 43, and spring hangers, MSS Type 41 with Type 49, for individual horizontal runs 20 feet and longer.
3. Pipe roll, complete MSS Type 44 for multiple horizontal runs, 20 feet or longer, support on a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

Nom. Pipe Size-In.	Steel Pipe Size -In.	Copper Tube Max. Span - Ft.	Min. Rod Dia. -In.
Up to 3/4	7	5	3/8
1	7	6	3/8
1-1/4	7	7	3/8
1-1/2	9	8	3/8
2	10	8	3/8
2-1/2	11	9	3/8
3	12	10	1/2
3-1/2	13	11	1/2
4	14	12	5/8 (1/2 for copper)
5	16	13	5/8 (1/2 for copper)
6	17	14	3/4 (5/8 for copper)
8	19	16	7/8 (3/4 for copper)
10	22	18	7/8 (3/4 for copper)
12	23	19	7/8 (3/4 for copper)

D. Support vertical steel pipe and copper tube at each floor.

3.06 PIPE AND TUBE JOINT CONSTRUCTION

A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."

B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
   1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering and brazing.
   2. Fill the tubing and fittings during soldering and brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.
   3. Heat joints to proper and uniform temperature.

C. Threaded Joints: Conform to ASME B1.20.1, tapered pipe threaded for field-cut threads. Join pipe fittings and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   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. Assembly joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
      a. Damaged Threads: Do not use pipe with corroded or damaged threads. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

D. Flanged Joints: Align flange surfaces parallel. 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 with a torque wrench.

E. Grooved-End Joints: Prepare pipe and tubing and install in accordance with manufacturer's installation instructions.

F. Install all PVC socket weld joints in accordance with manufacturer's recommendations and use cleaner and solvent as recommended by pipe manufacturer.

3.07 SERVICE ENTRANCE

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping is specified in separate section of Division 2 and Division 22.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

C. Install Shutoff valve at service entrance inside building; complete with strainer, pressure gage, and test tee with valve.

3.08 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, ball, and butterfly valves.
   2. Throttling duty: Use globe and ball valves.

3.09 INSTALLATION OF VALVES

A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as

indicated. For sectional valves 2 inches and smaller, use gate valves; for sectional valves 2-1/2 inches and larger, use gate or butterfly valves.

B. Shutoff Valves: Install shutoff valves at inlet and outlet of each plumbing equipment item and elsewhere as indicated.
   1. At plumbing equipment: 2" and smaller use gate or ball valves.
   2. At plumbing equipment: 2-1/2" and large use gate or butterfly valves.
   3. For plumbing fixtures see fixture trim.
   4. All other locations use gate valves.

C. Drain Valves: Install drain valves on each plumbing equipment item, located to drain equipment completely for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to drain distribution piping system completely. For drain valves use 3/4" hose end drain valve.

D. Check Valves: Install swing check valves on discharge side of each pump and elsewhere as indicated.

E. Balance Cocks: Install in each hot water re-circulating loop, discharge side of each pump, and elsewhere as indicated.

F. Hose Bibbs: Install on exposed piping where indicated. Provide vacuum breaker.

G. Wall Hydrants: Install where indicated. Provide vacuum breaker.

3.10 INSTALLATION PIPING SPECIALTIES

A. Install backflow preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".

B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

3.11 INSTALLATION OF PIPING WATER HAMMER ARRESTORS

A. Provide an air chamber at each valved water outlet or fixture supply for fixtures with manual closing valves. Air chamber shall be 18 inches long and one pipe size larger than supply to outlet. For a battery of fixtures, one air chamber 30 inches long and the full size of the header, but not less than 1 inch may be installed in lieu of individual air chambers. Precision Plumbing Products, JMJ "System Rated" arrestors are acceptable in lieu of air chambers.

B. Install water hammer arrestors on supply line to fixtures with self-closing, automatic or flushometer valves. Arrestors shall be as close as possible to individual fixtures and on the end of the header for a battery of fixtures. Arrestors shall be installed in the wall or furring, whenever possible, behind an access plate large enough to permit removal of the arrestor. Sizes as shown on the drawings or as specified hereinafter. Sizes and model numbers are J. R. Smith; equivalent arrestors by Josam or Zurn are acceptable.

3.12 EQUIPMENT CONNECTIONS

A. Piping Run-outs to Fixtures: Provide hot and cold water piping Run-outs to fixtures of sizes indicated, but in no case smaller than required by plumbing code.

B. Mechanical Equipment Connections: Connect hot and cold water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection; provide drain valve on drain connection. For connections 2-1/2 inches and larger, use flanges instead of unions.

3.13 FIELD QUALITY CONTROL

A. Inspections: Inspect water distribution piping as follows:
   1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the DSA Inspector and/or Inspector/Plumbing Official of authority having jurisdiction.
   2. During the progress of the installation, notify the DSA Inspector, and/or inspector/plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
      a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed in after system is roughed in and prior to setting fixtures.
      b. Final Inspection: Arrange for a final inspection by the DSA Inspector and/or Inspector/plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
   3. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection by the DSA Inspector and/or Inspector/plumbing official.
   4. Reports: Prepare inspection reports signed by the plumbing official.

B. Test water distribution piping as follows:
   1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
   2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
   3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to-stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
   4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
   5. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING

A. Clean and disinfect water distribution piping as follows:
   1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
   2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
      a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.
      b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
      c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.

d. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities.

3.15 COMMISSIONING

A. Fill the system. Check compression tanks, where used, to determine that they are not air bound and that the system is completely full of water.

B. Before operating the system, perform these steps:
1. Close drain valve, hydrants, and hose bibbs.
2. Open valves to full open position.
3. Remove and clean strainers.
4. Check pumps for proper direction of rotation. Correct improper wiring.
5. Lubricate pump motors and bearings.

END OF SECTION

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART1 GENERAL

1.01 SECTION INCLUDES

A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:
   1. Division 02 Section "Structural Excavation and Backfill", for trenching and backfilling materials and methods for underground piping installations.
   2. Division 22 Section "Plumbing Identification," for labeling and identification of drainage and vent piping.
   3. Division 33 Utilities

1.03 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.

B. Building Sewer: That part of the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal.

C. Drainage System: Includes all the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

1.04 SUBMITTALS

A. Product data for the following products:
   1. Drainage piping specialties

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. California Plumbing Code (CPC): Current edition in use by authority having jurisdiction.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof drains, flashing, and roof penetrations.

B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

D. Coordinate with installation of sanitary and storm sewer system as necessary to interface building drains with drainage piping system.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
   1. Drainage Piping Specialties, including backwater valves, expansion joints, drains, trap primers, and vandal-proof vent caps:
      a. Josam Mfg. Co.
      b. Smith (Jay R.) Mfg. Co.
      c. Tyler Pipe; Subs. of Tyler Corp.
      d. Zurn Industries Inc; Hydromechanics Div.

2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

A. General: Select from the following options:
   1. Pipe Sizes Larger than 2": Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with clamps and compression gasket joints conforming to ASTM C564. Piping shall bear the CISPI stamp.
   2. Pipe Sizes Larger than 2": Hub-less cast-iron soil pipe. Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310. Piping shall bear the CISPI stamp.
   3. Type "DWV" hard drawn copper waste, vents and end fittings. ASTM B32 for pipe, and cast bronze drainage pattern fittings with soldered joints.

B. All waste and vent piping occurring in demountable or minimum thickness partitions shall be type DWV copper from finish floor through roof.

2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

A. Pipe and fittings shall have heavy coating of coal tar varnish or asphaltum on both inside and outside surfaces.

B. General: For pipe and fittings below grade and/or below finish floor of floors on grade select from the following options:
   1. Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for standard weight hub and spigot soil pipe and fittings, with clamps and neoprene gasket, conforming to ASTM C564. Piping shall bear the CISPI stamp.
   2. Pipe Sizes 16" and Smaller: Hub-less cast iron soil pipe, conform to CISPI Standard 301, service weight; with "Best" or "MG" cast iron joint connection couplings. Coupling body shall conform to ASTM A-48 or ASTM A-74 with neoprene gasket conforming to ASTM C-564. Piping shall bear the CISPI stamp.

2.04 DRAINAGE PIPE SPECIALTIES

A. Trap Primers: Bronze body valve with automatic vacuum breaker, with 1/2 inch connections matching piping system. Complying with ASSE 1018.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

2.05 CLEANOUTS

A. Cleanouts on cast iron soil pipe, iron body with ABS plugs screwed into caulking ferrules. Cleanouts on steel pipe, ABS plugs. Cleanouts on vitrified clay pipe, vitrified clay pipe. Where cleanouts occur in finished interior surfaces, smooth polished chromium plated. Exposed parts of floor cleanouts in finished rooms, non-slip polished nickel bronze. Floor cleanouts adjustable type. Where cleanouts occur in carpeted floor areas, the cover shall be elevated so as to be

flush with finished carpeted areas.

B. Floor Cleanouts: Cast-iron body and frame, with cleanout plug and adjustable round top as follows:

1. Floor level type in rooms with concrete floor: Smith #4021, Josam 58330-2, or Zurn Z1420-25 with cast iron top.

C. Wall Cleanouts: Cast-iron body adaptable to pipe with ABS plastic plug; stainless steel cover including screws.
1. Wall type for cast iron pipes: Smith #4532, Josam 58790-4, or Zurn Z-1445-1.
2. Wall type for steel pipes: Smith #4472, Josam 58890-4, or Zurn 1460-8.

D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks, and cast-bronze stack flashing sleeve for copper tubing.

F. Vandal-Proof Vent Caps: Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

2.06 FLOOR DRAINS

A. Floor drains are specified in Section 22 42 00 "Plumbing Fixtures".

2.07 ROOF DRAINS

A. Roof drains are specified in Section 22 42 00 "Plumbing Fixtures."

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field dimensions. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.03 PIPE APPLICATIONS- ABOVE GROUND, WITHIN BUILDING

A. General: Select from following options:
   1. Install Copper tube with cast bronze fittings for 3 inch and smaller, drainage and vent pipe.
   2. Install hub-and spigot, service weight, cast-iron soil pipe with compression gasket joints for larger than 2 inches drainage and vent pipe.

   3. Install Hub-less, service weight, cast-iron soil pipe and fittings for larger than 2 inch drainage and vent pipe.

3.04 PIPE APPLICATIONS- BELOW GROUND, WITHIN BUILDING

A. General: Select from the following options:
   1. Install hub-and-spigot, service heavy weight, cast-iron, soil pipe and fittings with gasket joints for 15 inch and smaller drainage pipe.
   2. Install hub-less, service weight, cast-iron, soil pipe and "Best" or "MG" cast iron couplings with neoprene gaskets. Stainless steel couplings not acceptable below grade.

3.05 PIPE AND TUBE JOINT CONSTRUCTION

A. Copper Tubing: Solder joints in accordance with the procedures specified in AWS "Soldering Manual."

B. Cast-Iron Soil Pipe: Make lead and oakum caulked joints, compression joints, and hub-less joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

C. Install couplings per manufacturer's recommendations.

3.06 INSTALLATION

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inches and larger shall be sheet metal.

H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.

I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half wyes, or long sweep quarter, sixth, eight, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of

drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping 4 inch and larger.

L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 22.

M. Install sleeve and mechanical sleeve through foundation wall for watertight installation.

3.07 HANGERS AND SUPPORTS

A. General: Hanger, supports, and anchors devices are specified in Division 22 Section "Hangers and Supports." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

C. Install hangers at the following intervals:

PIPE MATERIAL	MAXHORIZ SPACING IN FT.	MAX VERT SPACING IN FT.
Cast-Iron Pipe	5	15
Copper Tubing- 1-1/2 inch and smaller	6	10
Copper Tubing - 2 inch and larger	10	10

3.08 INSTALLATION OF PIPE SPECIALTIES

A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.

C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
   1. As required by plumbing code.
   2. At each horizontal change in direction of piping greater than 135 degrees.
   3. At maximum intervals of 50' for piping 3" and smaller and 100' for larger piping.
   4. At base of each vertical soil or waste stack.

D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping.

E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.09 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow. Provide trap primer for all floor drains and floor sinks. Multiple outlet primers are acceptable.

3.10 CONNECTIONS

A. Piping Run-outs to Fixtures: Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

B. Locate piping run-outs as close as possible to bottom of floor slab supporting fixtures or drains.

3.11 FIELD QUALITY CONTROL

A. Inspections:
   1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
   2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
      a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
      b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
   3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspected by the plumbing official.
   4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test: Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:
   1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
   2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, which has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING

A. Clean interior of piping system. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.13 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION

SECTION 22 42 00

COMMERCIAL PLUMBING FIXTURES

PART1 GENERAL

1.01 SECTION INCLUDES

A. This section specifies plumbing fixtures and trim and includes the following fixture types:
   1. Lavatories (including accessible type).
   2. Service Sinks.
   3. Water Closets (including accessible type).
   4. Urinals (including accessible type).
   5. Mop Basins.
   6. Electric Water Coolers (including accessible type).
   7. Faucets.
   8. Flush Valves.
   9. Fixture Supports (including accessible type).
   10. Toilet Seats.
   11. Fittings, Trim, and Accessories.
   12. Floor Drains.
   13. Roof Drains.

1.02 RELATED SECTIONS

A. Separate grab bars and toilet accessories not an integral part of plumbing fixtures and are specified in Division 10.

B. Electrical requirements for mechanical equipment, water heaters, water conditioners, and other plumbing equipment are specified in other sections of Division 23.

1.03 SUBMITTALS

A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers, and water heaters.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 6 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

D. Maintenance Data: Include data in Maintenance Manual specified in Division 01 and Section 22 05 00.

E. Quality Control Submittals:
   1. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.
   2. Submit certification of compliance with performance verification requirements specified in this Section.

1.04 QUALITY ASSURANCE

A. Codes and Standards:

1. ASHRAE Standard 18: "Method of Testing for Rating Drinking Water Coolers with Self-Contained Mechanical Refrigeration System."
2. ARI Standard 1010: "Drinking-Fountains and Self-Contained Mechanically-Refrigerated Drinking-Water Coolers."
3. California Building Code 2019, Title 24, Part 2 for Accessibility Requirements.
   a. Accessible plumbing fixtures for adults; dimensions shall comply with the requirements of CCR, T-24, Section 11B-Division 6.
   b. Heights and location of fixtures shall be according to CCR, T-24, Section 11B -Division 6.
   c. Fixture Controls shall comply with CCR, T-24 Section 11B-Division 6.
4. UL Standard 399: "Drinking-Water Coolers."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.

B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.

1.06 SEQUENCE AND SCHEDULING

A. Schedule rough-in installations with the installation of other building components.

1.07 MAINTENANCE

A. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

B. Repair Kits: Furnish faucet repair kits complete with all necessary washers, springs, pins, retainer packing, 0-rings, sleeves, and seats in a quantity of 1 kit for each 10 faucets.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer uniformity shall be as specified in Section 22 05 00: "Common Work Results for Plumbing" under "Products, Materials and Equipment."

B. The following specification mentions manufacturers to establish a standard quality. The following fixtures and accessories are acceptable, if used throughout:
   1. Lavatories, Service Sinks, Water Closets, Urinals, Mop Basins, sinks:
      a. American Standard (Preferred District Standard)
      b. Kohler Co.
   2. Stainless Steel Sinks:
      a. Haws (Preferred District Standard)
      b. Elkay Mfg. Co.
   3. Faucets:
      a. Chicago Faucet Co. (Preferred District Standard)
      b. Or Equal, Section 01 33 13, Section 01 40 00, Section 01 60 00
   4. Flush Valves:
      a. Sloan Valve Co. (Preferred District Standard)
   5. Water Closet Seats:
      a. Beneke Corp
      b. Church Products
      c. Olsonite
   6. Fixture Supports:
      a. Josam Mfg. Co.

b. Zurn Industries, Inc.; Hydromechanics Div.
c. Jay R. Smith Manufacturing Co.

7. Drains
   a. Josam Mfg. Co.
   b. Jay R. Smith Manufacturing Co.
   c. Zurn

2.02 FIXTURES

A. Plumbing fixture trim and exposed supplies and wastes are to be brass with polished chromium plated finish unless otherwise specified. Provide individual loose key or screwdriver stops for all fixture supplies. Separately trap all wastes. Furnish chrome plated wall escutcheons for all exposed supplies and trap arms. Locate stops below fixtures or countertops. All fixtures for use by the disabled shall have exposed hot water pipe and tailpiece and trap insulated with 1/2" rubber foam insulation.

B. All plumbing fixture faucets submitted for review shall have identification label or certification showing compliance with California Title 24, Part 5, Article 1, "Energy Conservation Standards"; Article 1, T20-1406; Article 2, T20-1525 and Article 4, 1604, and 1606.

C. All High Performance Incentive (HPI) fixtures shall comply with the CHPS 2009 criteria. Water closets shall have a flow-rate of 1.28 gallons per flush, urinals a flow-rate of 0.125 gallons per flush and lavatories with metering faucets a flow-rate of 0.25 gallons per cycle.

2.03 FIXTURE SUPPORTS

A. Lavatory Supports: Adjustable cast iron, with thin concealed arms and sleeves, and complete with escutcheons and mounting fasteners.

B. Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Provide an appropriate model to suit deep or shallow rough-in, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.

C. Urinal support: adjustable steel tube with base and bottom bearing plate.

2.04 ESCUTCHEONS

A. Select one of the two options below:
   1. Chrome-plated cast brass with set screw.
   2. Chrome-plated sheet steel with friction clips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of 2019 California Building Code "CBC" Section Section 11B-Division 6 for accessible plumbing fixtures.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Securely attach wall hung fixtures to a 3/8 inch x 6 inch wide steel plate. Steel plate to extend at least one stud beyond first and last mounting point. Drill and tap plate at time of installation of fixture or fixture hanger. Support fixture hanger with 1/2" diameter threaded studs, jamb nuts, C.P. Acorn nuts and completely free of wall by means of a second set of jamb nuts. Weld plate to each metal stud crossed by means of a continuous vertical fillet weld and same size as stud thickness. Secure plate to each wood stud crossed by securely bolting to each stud crossed with two 1/2-inch steel bolts, 4-inch center with 1/8-inch maximum x 1-1/2 inch steel back up plates. Notch studs to set plate flush with surface.

E. Set mop basins in a leveling bed of cement grout.

F. Install a stop valve in an accessible location in the water connection to each fixture.

G. Install chrome plated brass escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and with cabinets and millwork.

H. Seal fixtures to walls and floors using silicone sealant as specified in Section 07900. Match sealant color to fixture color.

I. Provide abrasive washers under all single drilling deck mounted trim.

3.03 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

C. Trap all drains connected to the sanitary sewer.

D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

E. Position drains so that they are accessible and easy to maintain.

3.04 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow.

3.06 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.07 ADJUSTING

A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

B. Replace washers or leaking or dripping faucets and stops.

C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.08 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.09 PROTECTION

A. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Owner.

3.10 MOUNTING HEIGHTS SCHEDULE

FIXTURE	MOUNTING HEIGHT
Lavatory or Sink	See Architectural Drawings.
Wheelchair Lavatories	"
Water Closet	"
Accessible Water Closet	
Standard Urinals	
Accessible Urinals	
Wheelchair Water Cooler	

3.11 ROUGH-IN FOR FIXTURES

A. Rough-in for all fixtures and/or equipment are shown on drawings, including the architectural drawings, which forms a part of the contract documents. This shall include all fixtures and equipment shown and/or noted as N.I.C. (not in contract) or as U.O.S. (furnished under another Section of the specification). Stub out all piping to the exact location of the fixtures and set symmetrical with the fixture. Stub out for fixture supply pipes with drop ear fittings secured to stud or backing plate. Stub out two pipe diameter and terminate with pipe cap. When lines are indicated as capped or plugged at floor level, plug flush with the finished floor.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Sleeves.

2. Equipment installation requirements common to equipment sections.

3. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

B.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.2 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

C. Field Welding: Comply with AWS D1.1.

END OF SECTION

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.

2. Torque, speed, and horsepower requirements of the load.

3. Ratings and characteristics of supply circuit and required control sequence.

4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.02 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1.

2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motors 7.5 HP and larger; rolled steel for motor frame sizes smaller than 7.5 HP.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.

3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.

3. Capacitor start, inductor run.

4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.

2. Isolation mounts.

3. Restraining braces and cables.

1.3 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: 70mph, exposure C.

2. Building Classification Category: I = 1.0.

3. Minimum 10 lb/sq. ft. multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Seismic coefficients per CBC : See Design Section Note 4 on Sheet S0.01.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For professional engineer.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

1. M.W. Sausse.

2. California Dynamics Corporation.

3. Kinetics Noise Control.

4. Mason Industries.

5. MicroMetl

6. Or approved equal.

C. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

D. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4. Minimum Additional Travel: 50 percent of the required deflection at rated load.

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. M.W. Sausse.

2. Cooper B-Line, Inc.; a division of Cooper Industries.

3. Hilti, Inc.

4. Loos & Co.; Cableware Division.

5. Mason Industries.

6. TOLCO Incorporated; a brand of NIBCO INC.

7. Unistrut; Tyco International, Ltd.

8. Or approved equal.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

B. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Test and adjust air-mounting system controls and safeties.

9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

B. Adjust active height of spring isolators.

C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.

2. Duct labels.

3.

4. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Metal with date engraved or stamped for permanent attachment on equipment.

2. Data:

a. Product name, model number and serial number.

b. Capacity, oper. Power characteristics and essential data.

c. Labels of test compliances.

B. Plastic Tags for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having contact type, permanent adhesive.

2. Color Code.

3. Fasteners: As required to mount on equipment.

4. Label Content:

a. Name and plan number (e.g. exhaust fan EF-1).

b. Area served.

5. 2-1/2″ X 4″ for control devices, dampers and values 2X6 inches for equipment.

2.2 DUCT LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

C. Fasteners: Stainless-steel self-tapping screws.

D. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 DUCT LABEL INSTALLATION

A. Install duct labels with stainless steel-tapping screws on air ducts in the following color codes:

1. Green: For supply air ducts.

2. Blue: For exhaust-, outside-, relief-, return-air ducts.

3. ASME A13.1 Colors and Designs: For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes TAB to produce design objectives for the following:

1. Air Systems:

a. Constant-volume air systems.

1.2 SUBMITTALS

A. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 6 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

C. Warranties specified in this Section.

1.3 QUALITY ASSURANCE

A. TAB Firm Qualifications: Engage a TAB firm certified by AABC.

B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

1.4 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

B. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

C. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.5 WARRANTY

A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1. The certified TAB firm has tested and balanced systems according to the Contract Documents.

2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

B. Examine approved submittal data of HVAC systems and equipment.

C. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

G. Examine system and equipment test reports.

H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and

fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

K. Examine equipment for installation and for properly operating safety interlocks and controls.

L. Examine automatic temperature system components to verify the following:

1. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.

M. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system readiness checks and prepare system readiness reports. Verify the following:

1. Permanent electrical power wiring is complete.

2. Automatic temperature-control systems are operational.

3. Equipment and duct access doors are securely closed.

4. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.

D. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling unit components.

K. Check for proper sealing of air duct system.

3.4 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure fan static pressures to determine actual static pressure as follows:

a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.

b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.

d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.

3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.

4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.

5. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Make required adjustments to pulley sizes, motor sizes, and electrical connections to accommodate fan-speed changes.

6. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure terminal outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.

2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.5 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.6 PROCEDURES FOR HEAT-TRANSFER COILS

A. Refrigerant Coils: Measure the following data for each coil:

1. Dry-bulb temperature of entering and leaving air.

2. Wet-bulb temperature of entering and leaving air.

3. Airflow.

4. Air pressure drop.

5. Refrigerant suction pressure and temperature.

3.7 PROCEDURES FOR TEMPERATURE MEASUREMENTS

A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside-air, wet- and dry-bulb temperatures.

3.8 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.

2. Air Outlets and Inlets: 0 to minus 10 percent.

3.9 FINAL REPORT

A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems. Provide four (4) hard copies and one (1) electronic copy (PDF format).

B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1. Include a list of instruments used for procedures, along with proof of calibration.

C. Final Report Contents: In addition to certified field report data, include the following:

1. Fan curves.

2. Manufacturers' test data.

3. Field test reports prepared by system and equipment installers.

4. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1. Title page.

2. Name and address of TAB firm.

3. Project name.

4. Project location.

5. Architect's name and address.

6. Engineer's name and address.

7. Contractor's name and address.

8. Report date.

9. Signature of TAB firm who certifies the report.

10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

a. Indicated versus final performance.

b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.

13. Data for terminal units, including manufacturer, type size, and fittings.

14. Notes to explain why certain final data in the body of reports varies from indicated values.

15. Test conditions for fans and pump performance forms including the following:

a. Settings for outside-, return-, and exhaust-air dampers.

b. Conditions of filters.

c. Cooling coil, wet- and dry-bulb conditions.

d. Face and bypass damper settings at coils.

e. Fan drive settings including settings and percentage of maximum pitch diameter.

f. Inlet vane settings for variable-air-volume systems.

g. Settings for supply-air, static-pressure controller.

h. Other system operating conditions that affect performance.

E. System Diagrams: Include schematic layouts of air systems. Present each system with single-line diagram and include the following:

1. Quantities of outside, supply, return, and exhaust airflows.

2. Duct, outlet, and inlet sizes.

3.10 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

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SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:

a. Mineral fiber.

2. Adhesives.

3. Mastics.

4. Lagging adhesives.

5. Sealants.

6. Field-applied cloths.

7. Field-applied jackets.

8. Tapes.

9. Securements.

10. Corner angles.

B. Related Sections:

1. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Qualification Data: For qualified Installer.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application, duct Installer for duct insulation application, and equipment Installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products:

a. Johns Manville; Microlite.

b. Knauf Insulation; Duct Wrap.

c. Owens Corning; All-Service Duct Wrap.

d. Or approved equal.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products:

a. Johns Manville; Micro-Lok.

b. Knauf Insulation; 1000 Pipe Insulation.

c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, [without factory-applied jacket] [with factory-applied ASJ] [with factory-applied ASJ-SSL]. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 ADHESIVES

A. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Mon-Eco Industries, Inc.; 22-25.

f. Or approved equal.

B. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

a. Childers Products, Division of ITW; CP-82.

b. Foster Products Corporation, H. B. Fuller Company; 85-20.

c. ITW TACC, Division of Illinois Tool Works; S-90/80.

d. Marathon Industries, Inc.; 225.

e. Mon-Eco Industries, Inc.; 22-25.

f. Or approved equal.

C. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products:

a. Dow Chemical Company (The); 739, Dow Silicone.

b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.

c. P.I.C. Plastics, Inc.; Welding Adhesive.

d. Red Devil, Inc.; Celulon Ultra Clear.

e. Speedline Corporation; Speedline Vinyl Adhesive.

f. Or approved equal.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.

1. Products:

a. Childers Products, Division of ITW; CP-35.

b. Foster Products Corporation, H. B. Fuller Company; 30-90.

c. ITW TACC, Division of Illinois Tool Works; CB-50.

d. Marathon Industries, Inc.; 590.

e. Mon-Eco Industries, Inc.; 55-40.

f. Vimasco Corporation; 749.

g. Or approved equal.

2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.

3. Service Temperature Range: Minus 20 to plus 180 deg F.

4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.

5. Color: White.

6. Or approved equal.

2.4 SEALANTS

A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:

a. Childers Products, Division of ITW; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.

3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.

5. Color: White.

2.5 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric for Pipe Insulation: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch for covering pipe and pipe fittings.

1. Products:

a. Vimasco Corporation; Elastafab 894.

b. Or approved equal.

B. Woven Glass-Fiber Fabric for Duct and Equipment Insulation: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. inch for covering equipment.

1. Products:

a. Childers Products, Division of ITW; Chil-Glas No. 5.

b. Or approved equal.

C. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch, in a Leno weave, for duct, equipment, and pipe.

1. Products:

a. Foster Products Corporation, H. B. Fuller Company; Mast-A-Fab.

b. Vimasco Corporation; Elastafab 894.

c. Or approved equal.

2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:

a. Johns Manville; Zeston.

b. P.I.C. Plastics, Inc.; FG Series.

c. Proto PVC Corporation; LoSmoke.

d. Speedline Corporation; SmokeSafe.

e. Or approved equal.

2. Adhesive: As recommended by jacket material manufacturer.

3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

5. Factory-fabricated tank heads and tank side panels.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and U. L. Listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.

b. Compac Corp.; 104 and 105.

c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.

d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

e. Or approved equal.

2. Width: 3 inches.

3. Thickness: 11.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and U. L. Listed.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.

b. Compac Corp.; 110 and 111.

c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.

d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.

e. Or approved equal.

2. Width: 3 inches.

3. Thickness: 6.5 mils.

4. Adhesion: 90 ounces force/inch in width.

5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.

b. Compac Corp.; 130.

c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.

d. Venture Tape; 1506 CW NS.

e. Or approved equal.

2. Width: 2 inches.

3. Thickness: 6 mils.

4. Adhesion: 64 ounces force/inch in width.

5. Elongation: 500 percent.

6. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

b. Compac Corp.; 120.

c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.

d. Venture Tape; 3520 CW.

e. Or approved equal.

2. Width: 2 inches.

3. Thickness: 3.7 mils.

4. Adhesion: 100 ounces force/inch in width.

5. Elongation: 5 percent.

6. Tensile Strength: 34 lbf/inch in width.

E. SECUREMENTSBands:

1. Products:

a. Childers Products; Bands.

b. PABCO Metals Corporation; Bands.

c. RPR Products, Inc.; Bands.

d. Or approved equal.

F. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [0.106-inch-] [0.135-inch-] diameter shank, length to suit depth of insulation indicated.

    a. Products:

        1) AGM Industries, Inc.; CWP-1.

        2) GEMCO; CD.

        3) Midwest Fasteners, Inc.; CD.

        4) Nelson Stud Welding; TPA, TPC, and TPS.

        5) Or approved equal.

2. Manufacturers:

    a. C & F Wire.

    b. Childers Products.

    c. PABCO Metals Corporation.

    d. RPR Products, Inc.

    e. Or approved equal.

2.8 CORNER ANGLES

A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.

2. Verify that surfaces to be insulated are clean and dry.

3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.

2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

   a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

O. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.

2. Testing agency labels and stamps.

3. Nameplates and data plates.

4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.

2.

3.

D. MINERAL-FIBER INSULATION INSTALLATIONBlanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

   b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

   d. Do not overcompress insulation during installation.

   e. Impale insulation over pins and attach speed washers.

   f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory-

or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.

2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6 FINISHES

A. Duct and Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Supply, return and outside air ducts.

B. Items Not Insulated:

1. Fibrous-glass ducts.

2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.

3. Factory-insulated flexible ducts.

4. Factory-insulated plenums and casings.

5. Flexible connectors.

6. Vibration-control devices.

7. Factory-insulated access panels and doors.

8. Exposed - to - view ducts within conditioned space they serve. (e.g. gymnasium).

9. Exhaust ducts.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed supply, return, outside air and relief ducts:

1. Mineral-fiber blanket: Thickness and density to achieve R8.0 installer R-value.

3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None (Concealed ducts have FSK facing).

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

END OF SECTION

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SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.

1.3 DEFINITIONS

A. Commissioning Plan: Document that outlines organization, schedule, allocation of resources, and documentation requirements of commissioning process.

B. CxA: Commissioning Authority.

C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at direction of CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meeting.

D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by CxA.

E. Provide information requested by CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for complete range of testing for required test period.

1.5 CxA'S RESPONSIBILITIES

A. Provide Project-specific construction pre-functional component and functional systems checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. The contractor shall provide following information to CxA for inclusion in commissioning plan:

1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during construction phase.
3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Verification of testing, adjusting, and balancing reports.

1.7 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to Contract Documents.

B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to Contract Documents, and that pretest set points have been recorded.

C. Certify 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. 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 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 CxA.

3.2 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to CxA.

B. Notify CxA at least 10 days in advance of testing and balancing Work, and provide access for CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at direction of CxA.

1. CxA will notify testing and balancing Subcontractor 10 days in advance of date of field verification. Notice will not include data points to be verified.
2. Testing and balancing Subcontractor shall use same instruments (by model and serial number) that were used when original data were collected.
3. Failure of item includes, other than sound, 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, deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
4. Remedy deficiency and notify CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at direction of 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. CxA along with 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 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 CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. CxA may direct that set points be altered when simulating conditions is not practical.

H. CxA may direct that sensor values be altered with signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of deficiency outside scope of HVAC&R system, document deficiency and report it to Owner. After deficiencies are resolved, reschedule tests.

J. If testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R SYSTEMS, SUBSYSTEMS, AND EQUIPMENT TESTING PROCEDURES

A. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 15 Sections "HVAC Instrumentation and Controls" and "Sequence of Operation." Assist CxA with preparation of testing plans.

B. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of refrigerant compressors and condensers, heat pumps, and other refrigeration systems. CxA shall determine sequence of testing and testing procedures for each equipment item to be tested.

C. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION

SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. See Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

1.2 SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Damper schedule.

C. Field quality-control test reports.

D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 THERMOSTATS

A. Manufacturers:

1. Carrier Comfort Controls
2. Johnson Controls, Inc.
3. Trane; Worldwide Applied Systems Group
4. Or Equal

B. Electric, solid-state, microcomputer-based room thermostat.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on weekday, Saturday, and Sunday
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:

    a. Time of day.
    b. Actual room temperature.
    c. Programmed temperature.
    d. Programmed time.
    e. Duration of timed override.
    f. Day of week.
    g. System mode indications include "heating," "off," "fan auto," and "fan on."

C. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.
2. Adjusting Key: As required for calibration and cover screws.
3. Set-Point Adjustment: 1/2-inch- diameter, adjustment knob.

DAMPERS

A. Manufacturers:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. TAMCO (T. A. Morrison & Co. Inc.).
4. Or Equal

B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.

3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.4 CONTROL CABLE

A. Electronic and fiber-optic cables for control wiring are specified in Division 27 Section "Communications Horizontal Cabling."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

3.2 FIELD QUALITY CONTROL

A. 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 results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

END OF SECTION

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SECTION 23 09 93

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Division 23 Section "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 AIR-HANDLING-UNIT CONTROL SEQUENCES

A. Unit occupancy is determined from internally programmed time schedules unless vacation mode is initiated at the thermostat

B. Supply fan will run continuously during occupied periods

C. Economizer will adjust to minimum position when supply fan is on, otherwise economizer shall close.

D. Unit will determine heating and cooling mode by comparing the space temperature to the heating and cooling setpoints adjustable at the thermostat.

E. Thermostat shall maintain a fixed adjustable deadband between heating and cooling setpoints with adjustable high and low limits to setpoint adjustment

F. When thermostat is 2dF (adjustable) above cooling setpoint, first stage cooling call shall be initiated by the thermostat

G. Should the space temperature continue to fall away from setpoint and reach 3dF (adjustable) above cooling setpoint, second stage call shall be initiated by the thermostat

H. Outdoor fan shall enable when any compressor is on.

I. If economizer is present, call for first stage cooling exist, and return air dry bulb temperature exceeds outside air, economizer will modulate open without mechanical cooling. If a second stage cooling call exists, economizer will modulate open and first stage mechanical cooling shall start.

J. When thermostat is 2dF (adjustable) below heating setpoint, first stage heating call shall be initiated by the thermostat

K. Should the space temperature continue to fall away from setpoint and reach 3dF (adjustable) below heating setpoint, second stage call shall be initiated by the thermostat

L. Thermostat shall limit the number of cycles per hour of heating or cooling by a user adjustable setpoint and enforce an adjustable time guard before second stage is started after a first stage call.

M. When no demand is present, all stages of cooling and heating shall disable but fan shall continue to run

N. When not scheduled to run, the unit fan shall disable and unit shall reference unoccupied setpoints. Unit will run fan, heating, and cooling during unoccupied times when space temperature is outside of unoccupied setpoints.

O. During unoccupied periods, if the override button is pressed on the thermostat, the unit shall enter occupied mode for 30 minutes for each button press, up to 4 hours. Override shall also be able to be cancelled through this button.

P. Unit shall enable prior to occupancy if the space temperature is outside the occupied setpoints to bring the space to setpoint at the occupied time.

Q. Thermostat shall run fan prior to occupancy for an adjustable time for pre-occupancy purge cycle.

1.4 EXHAUST FANS

A. Interlock with light switch cycles fan.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 31 13

METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round and flat-oval ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2. Suspended ceiling components.

3. Structural members to which duct will be attached.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings,"

for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND MATERIALS

A. General Sealant Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 3 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2.6 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.

2. Ductmate Industries, Inc.

3. Hilti Corp.

4. Kinetics Noise Control.

5. Loos & Co.; Cableware Division.

6. Mason Industries.

7. TOLCO; a brand of NIBCO INC.

8. Unistrut Corporation; Tyco International, Ltd.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts

and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.[Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."]

3.2 SEAM AND JOINT SEALING

A. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

1. For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

a. Ducts that are located directly in zones they serve.

b. Ducts that have short runs from volume-control boxes to diffusers.

B. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."

1. For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

   a. Ducts that are located directly in zones they serve.

   b. Ducts that have short runs from volume control boxes to diffusers.

3.3 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1 (Table 4-1M), "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

F. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."

2. Test the following systems:

a. Supply air.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4. Test for leaks before insulation application.

5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel.

B. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

C. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm or Lower: 90-degree tap.

b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.

2. Manual volume dampers.

3. Duct accessory hardware.

B. Related Sections:

1. Division 28 Section “Fire Detection and Alarm” for duct-mounted fire and smoke detector.

1.3 SUBMITTALS

A. Product Data: For each of the following type of products.

1. Backdraft and pressure relief dampers.

2. Manual volume dampers.

3. Duct accessory hardware.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

PART 2 - PRODUCTS

2.1 SHEET METAL MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60.

2. Exposed-Surface Finish: Mill phosphatized.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT DAMPERS

A. Manufacturers:

1. Air Balance Inc.; a division of Mestek, Inc.

2. Greenheck Fan Corporation.

3. Ruskin Company.

4. Or approved equal.

B. Description: Multiple-blade, parallel action gravity balanced, with blades of maximum 6-inches width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.

C. Maximum System Pressure: 1-inch wg.

D. Frame: 0.052-inch- thick aluminum sheet.

E. Blades: Multiple single-piece blades, 0.050-inch- thick aluminum sheet with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Neoprene.

H. Blade Axles:

1. Material: Galvanized steel.

2. Diameter: 0.20 inch.

I. Tie Bars and Brackets: Galvanized steel.

J. Return Spring: Adjustable tension.

2.3 MANUAL VOLUME DAMPERS

A. Manufacturers:

1. Rectangular Duct:

a. Greenheck

b. Air Balance

2. Round Duct:

a. OMNI

b. Duro-dyne

B. General Description:

1. Rectangular Dampers:

a. Rectangular Volume Dampers: Greenheck Model VCD-1000 galvanized steel assembly with 16 ga. Frame, 16 ga. Interlocked opposed blades, ½" pins with nylon bushings, ½" extended shaft and Duro-Dyne K-5 locking quadrant.

b. Vertical Pressure Relief Dampers: Greenheck Model WD-330 assembly with 18 ga. Galvanized steel frame, interlocked aluminum parallel blades with felt lined edges, 3/16" pins and nylon bushings.

c. Horizontal Pressure Relief Dampers: Greenheck Model WD-100 assembly with 18 ga. Galvanized steel frame, spring assisted interlocked aluminum parallel blades with felt line edges, 3'16" pins and nylon bushings.

2. Round Dampers:

a. Galvanized steel assembly with 22 ga. Blade, 3/8" shaft, Duro-Dyne SB-338 close end bearing and Duro-Dyne KR-3 locking quadrant.

2.4 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts.

C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Coordinate subparagraphs below with Division 23 Section "Metal Ducts." Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Centrifugal roof ventilators.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound-power ratings.

3. Motor ratings and electrical characteristics, plus motor and electrical accessories.

4. Material thickness and finishes, including color charts.

5. Dampers, including housings, linkages, and operators.

6. Roof curbs.

7. Fan speed controllers.

B. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. 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.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Greenheck.

2. Loren Cook Company.

3. Penn Ventilation.

4. Or approved equal.

B. Description: Direct-driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.

C. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

2. Hinged Sub-base: Galvanized-steel hinged arrangement permitting service and maintenance.

D. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable, 1/2-inch (13-mm) mesh, aluminum or brass wire.

4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- (40-mm-) thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch (40-mm) wood nailer. Size as required to suit roof opening and fan base.

1. Configuration: Built-in raised cant and mounting flange.

2. Overall Height: 12 inches.

3. Pitch Mounting: Manufacture curb for roof slope.

4. Metal Liner: Galvanized steel.

5. Burglar Bars: 1/2-inch thick steel bars welded in place to form 6-inch (150-mm) squares.

6. Mounting Pedestal: Galvanized steel with removable access panel.

7. Vented Curb: Unlined with louvered vents in vertical sides.

G. Capacities and Characteristics: Refer to contract documents.

1. Vibration Isolators:

a. Type: Noeprene type.

2.2 MOTORS

A. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."

B. Enclosure Type: Totally enclosed, fan cooled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators having a static deflection of 1 inch. Vibration- and seismic-control devices are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

C. Secure roof-mounting fans to roof curbs with cadmium-plated hardware. Refer to Division 07 Section "Roof Accessories" for installation of roof curbs.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct

connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust damper linkages for proper damper operation.

6. Verify lubrication for bearings and other moving parts.

7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

9. Shut unit down and reconnect automatic temperature-control operators.

10. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

END OF SECTION

SECTION 23 37 13

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Duct Mounted Supply Diffusers

2. Duct Mounted Return Grilles

B. Related Sections:

1. Division 23 Section "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Ceiling suspension assembly members.

2. Method of attaching hangers to building structure.

3. Size and location of initial access modules for acoustical tile.

4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

5. Duct access panels.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 AIR DISTRIBUTION EQUIPMENT

A. Manufactures: Subject to compliance with requirements, provide products by one of the following:

B. Basic-of-Design Product: Subject to compliance with requirements, provide Anemostat Products; a Mestek company or comparable product by one of the following:

1. Price Industries.

2. Carnes.

3. Krueger.

4. Titus.

5. Or approved equal.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.3 Color Schedule

A. Provide color to match architects color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

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SECTION 23 81 19

PACKAGED GAS-ELECTRIC ROOFTOP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes packaged air-conditioning units with refrigerant compressors and controls, intended for indoor installations, with integral air.

B. Related Sections include the following:

1. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for isolation pads, spring isolators, and seismic restraints.

2. Division 23 Section "HVAC Instrumentation and Control for HVAC" for control devices not packaged with units.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated.

B. Field quality-control test reports.

C. Operation and Maintenance Data: For self-contained air-conditioners to include in emergency, operation, and maintenance manuals.

D. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. 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.

B. Energy-Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Units shall be designed to operate with HCFC-free refrigerants.

1.5 COORDINATION

A. Coordinate size, location, and connection details with roof curbs, equipment supports, and roof penetrations specified in Division 07 Section "Roof Accessories."

1.6 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained air-conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Four years from date of formal acceptance of work by the owner.

2. Additional five-year compressor parts and heat exchanger parts warranty for all air conditioning unit shall be provided by the Air Conditioning Unit Manufacturer; this warranty shall commence after the formal acceptance of work by the owner.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set of filters for each unit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Self-Contained Air-Conditioners:

a. Carrier Corp.

b. Trane Company (The); North American Commercial Group.

c. Or approved equal.

2.2 DESCRIPTION:

1. Natural gas fired roof mounted pull-through single zoned package air conditioning units, complete with housing, supply fan, heating components, cooling components, controls and factory furnished accessories. Units should be factory assembled, pipe, wired, tested and provided with operating refrigerant charge. Units shall be U.L. and C.E.C listed.

2. Housing shall be complete with structural frame and prepainted removable panels. Interior of the housing exposed to the air passage shall be provided with moistureproof sound insulation.

3. Supply Fan: Centrifugal type with wheels with forwardly curved blades.

   a. Direct drive for two (2) and three (3) ton units.

   b. Adjustable V-belt drive or five speed direct drive for four (4) ton and five (5) ton units.

   c. Adjustable V-belt drive for six (6) ton and larger units.

4. Supply Fan Motor: Rubber mounted unit with built-in automatic reset overload protection.

   a. Multi-speed motor for direct driven fans.

   b. Single speed motor for belt driven fans.

5. Heating components shall consist of low NOx furnace, with aluminized steel heat exchanger, induced draft burners, silent gas valve, automatic electric ignition and automatic reset high limit.

6. Cooling components shall consist of Freon 22 hermetic compressor with crankcase heater and rubber-in-shear isolators, air cooled condenser, cooling coil, refrigeration piping and controls including refrigerant low pressure switch and refrigerant high pressure switch.

7. Controls Integral to Unit: Circuit breakers, fuses, starters, contractors, relays, switches and other controls required for proper operation.

8. Factory Installed Accessories: Alternate motors and alternate drives where indicated on the Drawings.

9. Contractor Installed Accessories: Outside air hood with manual damper, compressor short cycle protector (TIME GUARD), thermostat shall be DDC for low voltage application, subbase, and filter rack: filters shall be as hereinafter specified.

10. Where indicated on the Drawings, air conditioning units shall be provided with factory furnished and Contactor installed modulating economizer with solid state enthalpy control.

11. Roof Curb: Carrier pitched roof variable height unitized curb with duct rails, gaskets, wood nailer and seismic brackets; curb shall be 8″ high at high point of roof.

12. Factory furnished seismic restraints/brackets including properly sized screws shall be installed in accordance with factory furnished instructions; instructions shall include seismic calculations by registered Structural Engineer.

13. Air conditioning units shall be suitable for outdoor installation.

2.3 AIR FILTERS

1. Fliters: Farr 30/30 U.L listed Class 2 throw away type units; filters (SFM listing 3175-140:006) shall have 25% efficiency based on ASHRAE Test Standard 52-76. MERV 13 per California Energy Code 2019.

2. Air conditioning Units: 2″ thick.

3. Equivalent: Eco-Air.

2.4 CONTROLS

A. Unit Microprocessor Control Panel: Controls unit functions, including refrigeration and safety controls, and the following:

1. Supply fan.

2. Supply-fan motor speed.

3. Economizer control.

4. Compressors.

5. Air-cooled condenser.

6. Panel-mounted control switch to operate unit in remote or local control mode, or to stop or reset.

7. Panel-mounted indication of the following:

a. Operating status.

b. System diagnostics and safety alarms.

c. Supply-air temperature set point.

d. Zone heating-temperature set point.

e. Supply-air pressure set point.

f. Economizer minimum position set point.

g. Supply-air-pressure, high-limit set point.

h. Monitor constant and variable motor loads.

i. Monitor variable frequency drive operation.

j. Monitor economizer cycle.

k. Monitor cooling load.

l. Monitor air distribution static pressure and ventilation air volumes.

8. Time-of-day control to cycle unit on and off.

9. Night-heat, morning warm-up cycle.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Anchor units to structure.

C. Install seismic restraints.

D. Install vibration spring isolators under base of unit, with minimum static deflection of 1 inch. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to self-contained air-conditioners with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Electrical Connections: Comply with requirements in Division 26 Sections for power wiring, switches, and motor controls.

3.3 FIELD QUALITY CONTROL

A. 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 results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 25 08 00

INTEGRATED AUTOMATION COMMISSIONING

PART 1 – GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Owners Project Requirements.

C. Basis of Design

D. Contractor and Vendor field start-up reports.

E. Close-out documentation including O&M Manuals.

F. Related Sections:

1. Section 01 33 00 “Submittals”

2. Section 01 91 00 “Commissioning”

3. Section 23 08 00 “Commissioning of HVAC”

4. Section 26 08 00 “Electrical Systems Commissioning”

5. Division 22 - “Plumbing”

6. Division 23 - “Heating Ventilating and Air Conditioning”

7. Division 26 - “Electrical”

1.2. SUMMARY

A. This Section includes requirements for commissioning the Integrated Automation system and equipment and supplements the general requirements specified in Division 01 Section 01 91 00 "Commissioning” and ties in with Section 23 08 00 “Commissioning of HVAC”.

PART 2 – PRODUCTS

2.1. FUNCTIONAL PERFORMANCE TESTING EQUIPMENT AND INSTRUMENTS

A. Contractor shall provide all tools, instruments, laptop computers, PDAs, software programs and services required to perform system Functional Performance Testing procedures. This includes providing the connection to systems to be tested, operation of the test equipment & instrumentation and generating test results as required.

PART 3 – EXECUTION

3.1. FUNCTIONAL PERFORMANCE TESTING

A. Prerequisites for Testing, in addition to those listed in Section 01 91 00 “Commissioning”

1. HVAC Instrumentation and Control Contractor shall verify proper wiring and termination of all I/O and submit documentation of outputs to the Commissioning Authority.

2. The operator’s work station shall be complete and ready to turn over to the Owner.

3.2. FUNCTIONAL PERFORMANCE TESTING

1. Detailed Testing Procedures: CxA, with HVAC Contractor, and HVAC Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for the Integrated Automation system. These will be based upon the approved Instrumentation and Control submittal.

2. Much of the Instrumentation and Control testing will be integrated with the HVAC equipment testing.

3. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems prior to the submittal of the final Commissioning Report.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. For connecting raceways, cables, wireways, cable trays, and busways to be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches , thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.
e. Or approved equal.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

3. Pressure Plates: Plastic. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 05 01

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to, the following:

1. Examine all other sections for work related to those other sections and required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.2 SUBMITTALS

A. General

1. Review of contractors submittals is for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for quantities; dimensions which shall be confirmed and correlated at the job site; fabrication processes and techniques of construction; coordination of work with that of all other trades and satisfactory performance of their work.

2. The Contractor shall review each submittal in detail for compliance with the requirements of the contract documents prior to submittal to the Architect. The Contractor shall "Ink Stamp" and sign each item of the submittal with a statement "CERTIFYING THE SUBMITTAL HAS BEEN REVIEWED BY THE CONTRACTOR AND COMPLIES WITH ALL THE REQUIREMENTS OF THE CONTRACT DOCUMENTS".

3. Where the construction documents indicate specific manufacturer(s) for any given product, it shall be considered a substitution if the contractor proposes to use any manufacturer other than those specifically named. The Contractor shall clearly and specifically identify each individual proposed substitution or proposed deviation from the requirements of the contract documents with a statement "THIS ITEM IS A SUBSTITUTION".

B. Material Lists and Shop Drawings:

1. Submit material list and equipment manufacturers for approval within 35 days of award of contract. Give name of manufacturer and where applicable, brand name, type and/or catalog number of each item. Listing of more than one manufacturer for any one item of equipment, or listing items "as specified", without both make and model or type designation, is not acceptable. Shop drawings shall not be submitted before approval of manufacturers list. The right is reserved to require submission of samples of any material whether or not particularly mentioned herein

2. Within three weeks after approval of the material and equipment manufacturers list, submit shop drawings for approval. Shop drawings shall be submitted in completed bound groups of materials (i.e., all lighting fixtures or all switchgear, etc.). Shop drawing shall be prepared by factory authorized representatives. Departure from the above procedure will result in resubmittals and delays.

3. Submittals which are intended to be reviewed as substitution or departure from the contract documents must be specifically noted as such or the requirements of the contract documents will prevail regardless of the acceptance of the submittal.

4. Shop drawings shall include dimensioned plans, elevations, details, wiring diagrams and descriptive literature of components parts where applicable.

5. The Contractor shall verify dimensions of equipment and be satisfied as to fit and that they comply with all code requirements relating to clear working space about electrical equipment prior to submitting shop drawings for approval.

6. Shop drawings shall include the manufacturer's projected days for shipment from the factory of completed equipment, after the equipment is released for production by the Contractor. It shall be the responsibility of the Contractor to insure that all material and equipment is ordered and installed in time to provide an orderly progression of the work, and to allow full occupancy and full operation of the facility at the scheduled completion date. The Contractor shall notify the Architect of any changes in delivery which would affect the project completion date.

C. The Contractor shall be responsible for incidental, direct and indirect costs resulting from the substitution of specified contract materials or work.

D. Maintenance and Operating Manuals

1. The Contractor shall furnish three copies of typewritten maintenance and operating manuals for all electrical equipment, fire alarm equipment, sound system equipment, etc., to the District and instruct District's personnel in correct operation of all equipment at completion of project.

2. Where these specifications indicate to provide District personnel with instructional training sessions, the Contractor shall videotape all such instructional sessions. The Contractor shall provide all equipment and personnel required to create a color VHS video and audio recording or other approved equal and shall turn over to the District a total of two (2) copies of each tape prepared.

3. Maintenance and operating manuals shall be bound in three-ring, hard-cover, plastic binders and shall be delivered to the District with letter of transmittal, carbon copy to the Architect.

E. Portable or Detachable Parts: The Contractor shall retain in his possession, and shall be responsible for all portable and detachable parts or portions of the installation such as fuses, keys, locks, adapters, locking clips, and inserts until final completion of contract work. These parts shall then be delivered to the District or his authorized representative and an itemized receipt obtained, with copies of receipt sent to the Architect.

F. Record Drawings

1. Provide and maintain in good order at the job site a complete set of electrical contract prints. Changes to the contract to be clearly recorded on this set of prints. No pay request by the Contractor will be granted without verification that the jobsite prints are up-to-date and current with the project construction. At the end of the project, the Contractor shall transfer all changes to one set of transparencies to be delivered unfolded to the Architect. Transparency drawings shall be prepared in an organized and clearly legible fashion by persons skilled in drafting techniques.

2. The actual location and elevation of all buried lines, boxes, monuments, vaults, stub-outs and other provisions for future connections shall be referenced to the building lines or other clearly established base lines and to approved bench marks. All measurements shall be witnessed by the job inspector who shall make his own record of the dimensions. Before the inspector signs the record drawings, he shall check his own dimensions against those on the drawings. If any necessary dimensions are omitted from the record drawings, the Contractor shall, at his own expense, do all excavation required to expose the buried work and to establish the correct locations.

3. The Contractor shall keep the "record" prints up to date and current with all work performed.

4. A mandrel shall be pulled through each conduit upon completion of the duct bank. All mandrelling must be done in the presence of the job inspector.

1.3 GENERAL SUMMARY OF ELECTRICAL WORK

A. The specifications and drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

B. Refer to the drawings and shop drawings of other trades for additional details which affect the proper installation of this work. Diagrams and symbols showing electrical connections are diagrammatic only. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

C. Before submitting a bid, the Contractor shall familiarize himself with all features of the building drawings and site drawings which may affect the execution of the work. No extra payment will be allowed for failure to obtain this information.

D. If there are omissions or conflicts between the drawings and specifications, clarify these points with the Architect before submitting bid.

1.4 LOCATIONS OF EQUIPMENT

A. The drawings indicate diagrammatically the desired locations or arrangements of conduit runs, outlets, equipment, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the work so as to secure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structure conditions encountered.

B. Where outlets are placed on a wall, locate symmetrically with respect to each other and other features or finishes on the wall.

C. In the event changes in the indicated locations or arrangements are necessary, due to developed conditions in the building construction or rearrangement of furnishings or equipment, such changes made without cost, providing the change is ordered before the conduit runs, etc., and work directly connected to same is installed and no extra materials are required.

D. Lighting fixtures in mechanical spaces are shown in their approximate location only. Do not install light outlets or fixtures until mechanical piping and duct work is installed, then install lights in a location to provide best lighting.

E. The locations of existing utilities, building, equipment and conduit shown on the drawings is approximate. Verify exact locations and routing of existing systems in the field. Include all costs in contract price for adjustment required to accommodate existing conditions.

F. Coordinate and cooperate in every way with other trades in order to avoid interference and assure a satisfactory job.

1.5 AIR CONDITIONING, HEATING, PLUMBING EQUIPMENT WIRING

Provide electrical work, materials, and control components required for proper operation of the air conditioning, heating and plumbing systems.

1.6 POWER, TELEPHONE AND CABLE TV UTILITIES' SERVICES

A. Utility Co. services and metering facilities shall conform to the requirements of the serving utility companies. Contractor shall verify service locations and requirements prior to rough-in.

B. Conform to all requirements of the serving utility companies. Location of transformer slab box and or manholes and pull boxes and routing of service conduits indicated on the drawings are approximate

and shall be verified with the serving utility company prior to installation. Installation of service shall not begin until approved drawings have been received from the serving utility company.

C. Within 30 calendar days of receipt of notice that the contract award has been made, the Contractor shall notify the New Business Departments of the District Office of the serving utility companies and shall provide information as to the total power, telephone, and signal requirements of the contract. The Contractor shall furnish at the same time information as to the estimated completion date of job or the date when the respective utility company circuits, will be ready for installation, energizing and activation of the service.

D. In addition to the requirements of the serving utility companies, all power, telephone and cable television service conduits for utility company circuits, shall be completely encased with concrete including under buildings.

1.7 QUALITY ASSURANCE

A. Work and materials in full accordance with the latest rules and regulations of the California Code of Regulations Title 24, Part 3 "California Electrical Codes", Title 8 "Division of Industrial Safety" the National Life Safety Code, and other applicable Federal and State laws and regulations.

B. All material and equipment shall be new and shall be delivered to the site in unbroken packages. All material and equipment shall be listed and labeled by Underwriters Laboratories or other recognized testing laboratories, where such listings are available. Comply with all installation requirements and restrictions pertaining to such listings.

C. Work and material shown on the drawings and in the specifications is new and included in the contract unless specifically indicated as existing or N.I.C. (not-in-contract).

D. Keep a copy of all applicable codes available at the job site at all times while performing work under this section. Nothing in plans or specifications shall be construed to permit work not conforming to the most stringent of codes.

1.8 CLEANING EQUIPMENT, MATERIALS, PREMISES

All parts of the equipment shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and all cracks and corners scraped out clean. Surfaces to be painted shall be carefully cleaned of grease and oil spots and left smooth, clean and in proper condition to receive paint finish.

1.9 JOB CONDITIONS - PROTECTION

Protect all work, materials and equipment from damage from any cause whatever and provide adequate and proper storage facilities during the progress of the work. All electrical equipment shall be stored in a weather-tight structure. Provide for the safety and good condition of all the work until final acceptance of the work by the District and replace all damaged or defective work, materials and equipment before requesting final acceptance.

1.10 CUTTING AND PATCHING

Perform cutting and patching of the construction work which may be required for the proper installation of the electrical work. Patching shall be of the same material, thickness, workmanship and finish as existing and accurately match surrounding work to the satisfaction of the Architect. Cutting of structural members shall not be done without notifying the Architect and obtaining DSA approval.

1.11 IDENTIFICATION

A. Panelboards, terminal cabinets, circuit breakers, disconnect switches, starters, relays, time switches, contactors, pushbutton control stations, and other apparatus used for the operation or control of feeders, circuits, appliances, or equipment shall be properly identified by means of descriptive nameplates or tags permanently attached to the apparatus and wiring.

B. Nameplates shall be engraved laminated phenolic. Shop drawings with dimensions and format shall be submitted to the Architect before installation. Attachment to equipment shall be with escutcheon pins, rivets, self-tapping screws or machine screws. Self-adhering or adhesive backed nameplates shall not be used.

C. Plates: All cover and device plates shall be furnished with engraved or etched designations under any one of the following conditions:

1. Three gang or larger gang switches.
2. Keyed and/or locking switches.
3. Pilot light switches.
4. Switches in locations from which the equipment or circuits controlled cannot be readily seen.
5. Manual motor starting switches.
6. Switches which serve other than lighting loads.
7. Where so indicated on the drawings.
8. As required on all control circuit switches, such as heater controls, etc.
9. Where receptacles are other than standard duplex receptacles to indicate voltage and phase.

D. Provide black-on-white laminated plastic nameplates engraved in minimum 1/4" high letters to correspond with the designations on the drawings. Provide other or additional information on nameplates where indicated.

E. For equipment containing or operating on circuits of more than 240 volts nominal, provide red-on-white laminated warning signs engraved in 1/2" high letters to read: "CAUTION - 480 (or as applicable) VOLTS AUTHORIZED PERSONNEL ONLY".

F. Wire and Cable Identification

1. Provide identification on individual wire and cable including sign systems, fire alarm, electrical power systems (each individual phase, neutral and ground), empty conduit pull ropes, and control circuit.
2. Identification shall be provided at each termination location, splice location, pullbox, junction box and equipment enclosure.

a. Individual wire and cable larger than #6 AWG or 0.25 inch diameter, shall be provided with polypropylene identification tag holders, with yellow polypropylene tags interchangeable black alpha/numeric characters. Character height 0.25 inch or TECH Products-“EVERLAST” series. Attach identification tags with plastic “tie” wraps, minimum of two for each tag. As manufactured by Almetek Industries-“EZTAG” series.

b. Individual wire and cable #6 AWG and smaller or smaller than 0.25 inch diameter, shall be provided with water and oil resistant, flexible, pressure sensitive machine embossed plastic tags that wrap a minimum of 360 degrees around the wire/cable diameter. The entire tag shall then be covered with a clear flexible waterproof plastic cover wrapped a minimum of 540 degrees around the wire/cable diameter and completely covering the identification.

c. Each identification tag location shall indicate the following information: circuit number, circuit phase, source termination and destination termination equipment name (or outlet number as applicable).

d. Provide permanent identification tags to all underground conduit runs at pullbox and at building entrance indicating purpose and location of other end.

3. Install identification after installation/pulling of wire/cable is complete, to prevent loss or damage to the identification.

G. Cardholders and cards shall be provided for circuit identification in panelboards. Cardholders shall consist of a metal frame retaining a clear plastic cover permanently attached to the inside of panel door. List of circuits shall be typewritten on card. Circuit description shall include name or number of circuit, area, and connected load.

H. Junction and pull boxes shall have covers marked with circuit numbers according to panel schedule. Data shall be lettered in a conspicuous manner with a color contrasting to finish.

I. Miscellaneous Electrical Equipment: Identify individually mounted starters, transformers, pullboxes, junction boxes, and related items as required by the use of such equipment with plates as for panelboards. All junction boxes shall be marked to indicate panel of origin, voltage, and circuit numbers within the box.

J. Auxiliary Systems, including Communications: Label to indicate function, routing and termination point of panelboard. Also, label any circuits providing power to this equipment and the panel of origin.

1.12 TESTING

A. The Contractor shall obtain an independent NETA certified testing laboratory that will provide all instrumentation and tests on the electrical system and equipment as hereinafter described and further directed by the Architect. The test shall be performed after the completion of all electrical systems. All tests shall be recorded and documented and submitted to the Architect for review.

B. The Testing Laboratory shall meet Federal OSHA criteria for accreditation of Testing Laboratories Title 29 Part 1907. Membership in the National Electrical Testing Association shall constitute proof of meeting aid criteria, for testing of electrical system.

1. Test for Phase to Ground Condition:

a. Open main service disconnect.

b. Isolate the system neutral from ground by removing the neutral disconnect link located in the service switchboard.

c. Close all submain disconnects.

d. Close all branch feeder circuit breakers.

e. Measure the resistance of each phase to ground. A properly calibrated "megger" type test instrument to be used. The test voltage shall be 500 volts.

f. Record all readings after one minute duration and document into a complete report.

2. Isolating Grounds: In the event that low resistance grounds are found in the system, they shall be isolated and located by testing each circuit individually as outlined above. Make proper corrections to restore the resistance values to an acceptable value.

C. Method of obtaining ground resistance shall be in accordance with the latest edition of the James G. Biddle (Plymouth Meeting, Pennsylvania) manual published on this subject.

1. Perform "fall-of-potential" tests on each grounding electrode of system per IEEE Standard No. 81, Section 8.2.1.5. When suitable locations for test rods are not available, a low resistance dead earth or reference ground will be utilized.

2. Perform the two-point method test per IEEE Standard No. 81, Section 8.2.1.1, to determine the ground resistance at each ground bus in distribution boards and distribution panels and transformer neutrals.

D. All instrumentation and personnel required for testing shall be furnished by the Contractor.

E. The testing, calibrating and setting of all ground and ground fault equipment circuit breakers, device protection relays, and meters adjustable settings shall be by an independent testing laboratory. Set as recommended by the respective manufacturer and coordination study so as to be coordinated with other protection devices within the electrical design. Four (4) bound and tabulated copies of the test and settings shall be sent to the ARCHITECT.

F. Ampere and voltage measurements:

1. Take and record ampere and line voltage measurements under full load on all panel feeders, switchboard and switchgear feeders, motor control centers and motor circuits provided in the contract. Record measurements at the equipment tested and submit to the ARCHITECT for review.

2. Ampere voltage readings shall be:

a. Phase A-B, A-C and B-C.

b. Phase A-Neutral, B-Neutral and C-Neutral.

3. The ampere and voltage readings shall be not less than 20 minutes duration for each test. Record and submit the measured minimum, maximum and 20 minute average for each ampere and voltage value and test location. Voltage and ampere measurements shall occur at the connected load end of each respective feeder, not at the source of supply end of each feeder.

4. Test equipment shall be accurate within plus or minus 1-percent.

5. Branch circuit devices 40 ampere or less and motor boards 10 horsepower or smaller are excluded from ampere and voltage testing requirement.

G. If, in the opinion of the Architect, the voltages and regulations are not met within acceptable limits, make arrangements with the serving utility for proper electrical service and then verify that such has been provided.

1.13 SERIES RATED EQUIPMENT

Circuit protective devices identified as "Series Rated" or "Current Limiting" (i.e., CLCB - current limiting circuit breaker; CLF - current limiting fuse; etc.) shall be series rated and tested (UL 489 and CSA5) by the manufacturer with all equipment and circuit protective devices installed down stream of the identified series rated or current limiting devices. Provide nameplates on all equipment located down stream, including the CLCB and CLF devices, to comply with N.E.C. paragraphs 110-22 and 240-83 "CAUTION SERIES RATED SYSTEM - NEW DEVICE INSTALLATIONS AND REPLACEMENTS SHALL BE THE SAME MANUFACTURER AND MODELS."

1.14 SPARE FUSES

Provide (3) three spare fuses for each size and type to match the installed fuses where the fuses are provided as part of the contract.

1.15 WALL MOUNTED ELECTRICAL EQUIPMENT

A. Provide multiple horizontal sections of metal “C” channels for support and attaching wall mounted equipment to walls. Channels shall provide “turned lips” at longitudinal edges to hold “lock-in” fasteners and shall comply with ANSI-1008 and ASTM-A569 latest revision. The channels shall be steel hot dip zinc galvanized. As manufactured by Unistrut or Kindorf.

B. The “C” channels shall be positioned horizontally within 3 inches of the top and bottom of each, equipment section cabinet and located behind each equipment vertical section. Provide additional intermediate “C” channels at not less than 36 inches on center between the “top” and “bottom” “C” channel positions, located behind each equipment vertical section.

C. The “C” channels shall be of sufficient length to provide connection to not less than two (2) vertical structural wall framing elements separated by not less than 16 inches; but in no case shall the “c” channel length be less than the width of the respective equipment section.

D. Attach the “C” channels to the wall structural elements after the wall, finish surface, installation (including painting) is complete.

E. Attach the “C” channels with fasteners to the building wall framing structural elements as follows: welded to steel framing; bolted to wood framing; cast in place concrete inserts for masonry and concrete construction; drilled “afterset” expansion anchors for existing masonry and concrete construction.

F. Attach the equipment to the “C” channels with threaded and bolted fasteners to “prelocate” and lock into the channel “turned lips” and channel walls.

1.16 ELECTRICAL WORK CLOSEOUT

A. Prepare the following items and submit to the Architect before final acceptance.

1. Two copies of all test results as required under this section.

2. Two copies of local and/or state code enforcing authorities final inspection certificates.

3. Copies of as-built record drawings as required under the General Conditions, pertinent Division One Sections and Electrical General Provisions.

4. Two copies of all receipts transferring portable or detachable parts to the District when requested.

5. Notify the Architect in writing when installation is complete and that a final inspection of this work can be performed. In the event any defect or deficiencies are found during this final inspection they shall be corrected to the satisfaction of the Architect before final acceptance can be issued.

B. The Contractor shall complete the following work before any electrical equipment is energized:

1. All equipment shall be permanently anchored.

2. All bus connections shall be tightened per manufacturer's instructions and witnessed by the DSA Inspector.

3. All ground connections shall be completed and identified. Perform and successfully complete all required megger and ground resistance tests.

4. All feeders shall be connected and identified.

5. The interiors of all electrical enclosures including busbars and wiring terminals shall be cleaned of all loose material and debris, paint, plaster, cleaners or other abrasive's overspray removed and equipment vacuumed clean. The DSA Inspector shall observe all interiors before covers are installed.

6. All dry wall work and painting shall be completed within the electrical rooms.

7. All doors to electrical equipment rooms shall be provided with locks in order to restrict access to energized equipment.

8. Electrical rooms shall not be used as a storage room after power is energized.

9. The coordination study shall be complete, circuit breakers ground relays set, tested and calibrated accordingly.

END OF SECTION

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.

2. Connectors, splices, and terminations rated 600 V and less.

3. Sleeves and sleeve seals for cables.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for cabling used for voice and data circuits.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For testing agency.

C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. 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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.
6. Or approved equal.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THW THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Tyco Electronics Corp.
6. Or approved equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.4 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Or approved equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic. Include two for each sealing element.

3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper - solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.

I. Class 1 Control Circuits: Type THHN-THWN in raceway.

J. Class 2 Control Circuits: Type THHN-THWN in raceway. Power-limited cable, concealed in building finishes.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal conduits and cables in floor slabs, finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both wall surfaces.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space `between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.

M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

3.6 SLEEVE-SEAL INSTALLATION

A. Install to seal underground exterior-wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors, and conductors feeding the following critical equipment and services for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

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SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:

1. Underground distribution grounding.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including he following:

1. Grounding arrangements and connections for separately derived systems.

2. Grounding for sensitive electronic equipment.

C. Qualification Data: For testing agency and testing agencies field supervisor.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS NFPA 70B.

a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.

b. Include recommended testing intervals.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.

B. 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.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.

2. Stranded Conductors: ASTM B 8.

3. Tinned Conductors: ASTM B 33.

4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.

2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

2.02 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad; 3/4 inch by10 feet in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No.6 AWG and larger, unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.

4. Connections to Structural Steel: Welded connectors.

3.02 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

D. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.

2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.03 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

C. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts

of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.

3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

D. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

E. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

F. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.

2. Bury ground ring not less than 24 inches from building foundation.

G. User Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

b. Perform tests by fall-of-potential method according to IEEE 81.

3. Prepare dimensioned drawings locating each test well, ground rod and ground rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and less: 5 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

2. Construction requirements for concrete bases.

B. Related Sections include the following:

1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.05 SUBMITTALS

A. Product Data: For the following:

1. Steel slotted support systems.

2. Nonmetallic slotted support systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.

3. Nonmetallic slotted channel systems. Include Product Data for components.

4. Equipment supports.

C. Welding certificates.

1.06 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.07 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. ERICO International Corporation.

d. GS Metals Corp.

e. Thomas & Betts Corporation.

f. Unistrut; Tyco International, Ltd.

g. Wesanco, Inc.

3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.

4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

6. Channel Dimensions: Selected for applicable load criteria.

B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch diameter holes at a maximum of 8 inches o.c., in at least 1 surface.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.; a division of Cooper Industries.

c. Fabco Plastics Wholesale Limited.

d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.

4. Fitting and Accessory Materials: Same as channels and angles.

5. Rated Strength: Selected to suit applicable load criteria.

C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non- armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Hilti Inc.

2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

3) MKT Fastening, LLC.

4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Empire Tool and Manufacturing Co., Inc.

3) Hilti Inc.

4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by scheduled in NECA 1, and where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.

2. To New Concrete: Bolt to concrete inserts.

3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.

6. To Light Steel: Sheet metal screws.

7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.03 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.04 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

2. Install anchor bolts to elevations required for proper attachment to supported equipment.

3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field- painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:

1. Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquidtight flexible metal conduit.

F. LFNC: Liquidtight flexible nonmetallic conduit.

G. NBR: Acrylonitrile-butadiene rubber.

H. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

2. For handholes and boxes for underground wiring, including the following:

a. Duct entry provisions, including locations and duct sizes.

b. Frame and cover design.

c. Grounding details.

d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

e. Joint details.

C. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.

2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For professional engineer and testing agency.

F. Source quality-control test reports.

1.05 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.

2. Alflex Inc.

3. Allied Tube & Conduit; a Tyco International Ltd. Co.

4. Anamet Electrical, Inc.; Anaconda Metal Hose.

5. Electri-Flex Co.

6. Manhattan/CDT/Cole-Flex.

7. Maverick Tube Corporation.

8. O-Z Gedney; a unit of General Signal.

9. Wheatland Tube Company.

10. Or approved equal.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. LFMC: Flexible steel conduit with PVC jacket.

F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.

2. Fittings for EMT: compression type.

3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch with overlapping sleeves protecting threaded joints.

G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.

2. Anamet Electrical, Inc.; Anaconda Metal Hose.

3. Arnco Corporation.

4. CANTEX Inc.

5. CertainTeed Corp.; Pipe & Plastics Group.

6. Condux International, Inc.

7. ElecSYS, Inc.

8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.

10. Manhattan/CDT/Cole-Flex.

11. RACO; a Hubbell Company.

12. Thomas & Betts Corporation.

13. Or approved equal.

B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.

C. LFNC: UL 1660.

D. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

E. Fittings for LFNC: UL 514B.

2.03 OPTICAL FIBER/COMMUNICATIONS CABLE RACEWAY AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arnco Corporation.

2. Endot Industries Inc.

3. IPEX Inc.

4. Lamson & Sessions; Carlon Electrical Products.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.
14. Or approved equal.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.

F. Nonmetallic Floor Boxes: Nonadjustable, round.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.

I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

J. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.05 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray or Green.

2. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC", "TELEPHONE", or as indicated for each service.

6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. CDR Systems Corporation.

d. NewBasis.

e. Or approved equal.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. Christy Concrete Products.

d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

e. Or approved eqaul.

2.06 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

2.07 SLEEVE SEALS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Or approved equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.08 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: Rigid steel conduit IMC type EPC-40-PVC and Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: Rigid steel conduit IMC or EMT.
3. Underground Conduit: RNC, Type EPC-40 and 80-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
6. Application of Handholes and Boxes for Underground Wiring:
    a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
    b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.

c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.

2. Exposed, Not Subject to Severe Physical Damage: EMT.

3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit or IMC. Includes raceways in the following locations:

a. Loading dock.

b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.

c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.

5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

6. Damp or Wet Locations: Rigid steel conduit or IMC.

7. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.

8. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.

9. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.

10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel or nonmetallic in damp or wet locations.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

F. Do not install aluminum conduits in contact with concrete.

3.02 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

3. Change to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.

I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.

2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.

3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

2. Where otherwise required by NFPA 70.

N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.

1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:

a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.

b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.

c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.

d. Attics: 135 deg F temperature change.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg. F of temperature change.

3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.

2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

Q. Set metal floor boxes level and flush with finished floor surface.

R. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.

2. Install backfill as specified in Division 31 Section "Earth Moving."

3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

F. Cut sleeves to length for mounting flush with both surfaces of walls.

G. Extend sleeves installed in floors 2 inches above finished floor level.

H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed or unless seismic criteria require different clearance.

I. Seal space outside of sleeves with grout for penetrations of concrete and masonry.

J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."

L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.

M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

3.06 SLEEVE-SEAL INSTALLATION

A. Install to seal underground, exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.07 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.08 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.

2. Handholes and boxes.

3. Manholes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.

2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.

3. Accessories for manholes, handholes, boxes, and other utility structures.

4. Warning tape.

5. Warning planks.

B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Reinforcement details.

3. Frame and cover design and manhole frame support rings.

4. Ladder Step details.

5. Grounding details.

6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.

7. Joint details.

C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:

1. Duct entry provisions, including locations and duct sizes.

2. Cover design.

3. Grounding details.

4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

D. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.

2. Drawings shall be signed and sealed by a qualified professional engineer.

E. Product Certificates: For concrete and steel used in precast concrete manholes as required by ASTM C 858.

F. Qualification Data: For professional engineer and testing agency.

G. Source quality-control test reports.

H. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Architect's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

B. Furnish cable-support stanchions, arms, insulators, and specialties and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARNCO Corp.
2. Beck Manufacturing.
3. Cantex, Inc.
4. CertainTeed Corp.; Pipe & Plastics Group.
5. Condux International, Inc.
6. ElecSys, Inc.
7. Electri-Flex Company.
8. IPEX Inc.
9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type DB-120-PVC, ASTM F 512, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

D. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
    a. Color: Red dye added to concrete during batching.
    b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carder Concrete Products.
2. Christy Concrete Products.
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Riverton Concrete Products; a division of Cretex Companies, Inc.
6. Utility Concrete Products, LLC.
7. Utility Vault Co.
8. Wausau Tile, Inc.

C. Comply with ASTM C 858 for design and manufacturing processes.

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.

1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Frame and Cover: Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
3. Frame and Cover: Weatherproof steel frame, with hinged steel access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
4. Frame and Cover: Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
    a. Cover Hinges: Concealed, with hold-open ratchet assembly.
    b. Cover Handle: Recessed.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC." "TELEPHONE." As indicated for each service.
7. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
8. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
    a. Extension shall provide increased depth of 12 inches.
    b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
9. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

10. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

a. Type and size shall match fittings to duct or conduit to be terminated.

b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.

11. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

5. Cover Legend: Molded lettering, "ELECTRIC." "TELEPHONE." As indicated for each service.

6. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

7. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

8. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.

b. Carson Industries LLC.

c. CDR Systems Corporation.

d. NewBasis.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Armorcast Products Company.

   b. Carson Industries LLC.

   c. Christy Concrete Products.

   d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.

D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of cast iron.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carson Industries LLC.

   b. Christy Concrete Products.

   c. Nordic Fiberglass, Inc.

E. High-Density Plastic Boxes: Injection molded of high-density polyethylene or copolymer-polypropylene. Cover shall be hot-dip galvanized-steel diamond plate.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carson Industries LLC.

   b. Nordic Fiberglass, Inc.

   c. PenCell Plastics.

2.5 PRECAST MANHOLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carder Concrete Products.

2. Christy Concrete Products.

3. Elmhurst-Chicago Stone Co.

4. Oldcastle Precast Group.

5. Riverton Concrete Products; a division of Cretex Companies, Inc.

6. Utility Concrete Products, LLC.

7. Utility Vault Co.

8. Wausau Tile, Inc.

B. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

   a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.

c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

Type and size shall match fittings to duct or conduit to be terminated.

Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.

C. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.

D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.

2. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.

B. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-80-PVC, in direct-buried duct bank, unless otherwise indicated.

C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, Underground plastic utilities duct, NEMA Type DB-60-PVC, Underground plastic utilities duct, NEMA Type DB-120-PVC, installed in direct-buried concrete-encased duct bank, unless otherwise indicated.

E. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

F. Underground Ducts for Telephone, Communications, or Data Circuits: RNC, NEMA Type EB-20-PVC, in concrete-encased duct bank, unless otherwise indicated.

G. Underground Ducts Crossing Paved Paths, Walks and Driveways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:

1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.

2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.

3. Units Subject to Light-Duty Pedestrian Traffic Only: High-density plastic, structurally tested according to SCTE 77 with 3000-lbf vertical loading.

3.3 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.4 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, 12.5 feet, 25 feet, both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.

2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.

3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.

b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.

3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.

4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.

5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.

7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.

8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.

9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank.

Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.

2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.

3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches in nominal diameter.

4. Install backfill as specified in Division 31 Section "Earth Moving."

5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.

7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.

8. Set elevation of bottom of duct bank below the frost line.

9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.

    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.5 INSTALLATION OF HANDHOLES, AND BOXES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Install handholes with bottom below the frost line below grade.

2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 07 Section "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

E. Dampproofing: Apply dampproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Division 07 Section "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

G. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

I. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below the frost line below grade.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.

2. Dimensions: 10 inches wide by 12 inches deep.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.

3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

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SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

1. Identification for raceway and metal-clad cable.
2. Identification for conductors and communication and control cable.
3. Underground-line warning tape.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.04 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.05 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power Circuits: Black letters on an orange field.

2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.03 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.

2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

4. Printed legend shall indicate type of underground line.

2.04 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inchgalvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.05 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.06 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

2.07 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch.

2. Tensile Strength: 50 lb, minimum.

3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black, except where used for color-coding.

B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.

1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior concrete and masonry primer.

2) Finish Coats: Exterior semigloss acrylic enamel.

2. Exterior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.

2) Finish Coats: Exterior semigloss acrylic enamel.

3. Exterior Ferrous Metal:

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior ferrous-metal primer.

2) Finish Coats: Exterior semigloss alkyd enamel.

4. Exterior Zinc-Coated Metal (except Raceways):

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Exterior zinc-coated metal primer.

2) Finish Coats: Exterior semigloss alkyd enamel.

5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):

a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior concrete and masonry primer.

2) Finish Coats: Interior semigloss alkyd enamel.

6. Interior Concrete Unit Masonry:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.

1) Block Filler: Concrete unit masonry block filler.

2) Finish Coats: Interior semigloss acrylic enamel.

7. Interior Gypsum Board:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior gypsum board primer.

2) Finish Coats: Interior semigloss acrylic enamel.

8. Interior Ferrous Metal:

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior ferrous-metal primer.

2) Finish Coats: Interior semigloss acrylic enamel.

9. Interior Zinc-Coated Metal (except Raceways):

a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.

1) Primer: Interior zinc-coated metal primer.

2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 APPLICATION

A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.

2. Wall surfaces directly external to raceways concealed within wall.

3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl tape applied in bands.

D. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Fire Alarm System: Red.

2. Fire-Suppression Supervisory and Control System: Red and yellow.

3. Combined Fire Alarm and Security System: Red and blue.

4. Security System: Blue and yellow.

5. Mechanical and Electrical Supervisory System: Green and blue.

6. Telecommunication System: Green and yellow.

7. Control Wiring: Green and red.

E. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

G. Conductors to Be Extended in the Future: Attach [write-on tags] [marker tape] to conductors and list source and circuit number.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.

b. Controls with external control power connections.

2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

K. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:

a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.

b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.

b. Access doors and panels for concealed electrical items.

c. Electrical switchgear and switchboards.

d. Transformers.

e. Electrical substations.

f. Emergency system boxes and enclosures.

g. Motor-control centers.

h. Disconnect switches.

i. Enclosed circuit breakers.

j. Motor starters.

k. Push-button stations.

l. Power transfer equipment.

m. Contactors.

n. Remote-controlled switches, dimmer modules, and control devices.

o. Battery inverter units.

p. Battery racks.

q. Power-generating units.

r. Voice and data cable terminal equipment.

s. Master clock and program equipment.

t. Intercommunication and call system master and staff stations.

u. Television/audio components, racks, and controls.

v. Fire-alarm control panel and annunciators.

w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.

x. Monitoring and control equipment.

y. Uninterruptible power supply equipment.

z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.02 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 208/120-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

3. Colors for 480/277-V Circuits:

a. Phase A: Brown.

b. Phase B: Orange.

c. Phase C: Yellow.

4. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 26 08 00

ELECTRICAL LIGHTING SYSTEMS COMMISSIONING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Section Includes:

1. General requirements for Commissioning (Cx) of lighting systems components and lighting controls including installation, start-up, testing and documentation according to Construction Documents and Commissioning Plan (CxP).

2. Standard procedures for the execution of commissioning work shall be in conformance with Division 1, Section 01 91 00 General Commissioning Requirements. Coordinate all work with the Commissioning Agent (CxA).

1.2 RELATED SECTIONS:

1. Provisions of Division 01 apply to this section.

2. Section 01 91 00: Commissioning.

3. Section 01 78 23: Operations and Maintenance Data Training.

4. Section 26 05 00: Common Work Results for Electrical.

5. Section 26 05 01: Electrical General Provisions.

6. Section 26 09 23: Lighting Control Systems.

7. Section 26 50 00: Lighting Fixtures.

8. Project Commissioning Plan.

1.3 REFERENCES

A. Applicable codes, standards, and references: all inspections and tests shall be in accordance with the following applicable codes and standards, except as provided otherwise herein:

1. National Electrical Testing Association – NETA.

2. National Electrical manufacturer's Association – NEMA.

3. American Society for Testing and Materials – ASTM.

4. Institute of Electrical and Electronic Engineers – IEEE.

5. American National Standards Institute – ANSI.

6. National Electrical Safety Code – NESC.

7. California Building Code – CBC.

8. California Electrical Code – CEC.

9. Occupational Safety and Health Administration – OSHA.

10. National Institute of Standards and Technology – NIST.

11. ANSI/NFPA 70 – National Electrical Code.

12. NFPA 70E – Electrical Safety Requirements for Employee Work Places.

13. ANSI/NFPA 101– Life Safety Code.

1.4 SUBMITTALS

A. Submittals shall include the following:

1. Submit required Cx submittals in accordance with Division 1 Specification Sections.
2. Copy of the Architect's reviewed and accepted submittals to the CxA via the OAR.
3. List of team members who will represent the Contractor in the Pre-functional Equipment Checks and Functional Performance Testing, at least two (2) weeks prior to the start of Pre-functional Equipment Checks.
4. Detailed manufacturer installation and start-up, operating, troubleshooting and maintenance procedures, checklist documentation and field checklist forms to be used by factory or field technicians, and a copy of full details of Owner-contracted tests, full factory testing reports, if any, and Warranty information, including responsibilities of Owner to keep Warranty in force, clearly defined.
5. Detailed manufacturer's recommended procedures and schedules for Pre-functional Equipment Checks, supplemented by Contractor's specific procedures, and Pre-functional Tests, at least four (4) weeks prior to the start of Pre-functional Performance Tests.
6. After facility's commission is complete, submit all completed Pre-functional Equipment Checklists and Functional Performance Test checklists organized by system and by subsystem. Bind all information in a single package. The results of failed tests shall be included along with a description of the corrective actions taken.

1.5 MEETINGS, SEQUENCING AND SCHEDULING

A. Meetings: Attend (Cx) meetings as required under Section 01810 and the Cx Plan.

B. Sequencing and Scheduling: The work described in this Section shall begin only after all work required in related Division 16 Sections has been successfully completed, and all tests, inspection reports and Operation & Maintenance manuals required in Division 16 Sections have been submitted and approved. The start-up and Pre-functional Equipment Checklists shall be completed and submitted to the Owner's Authorized Representative (OAR) prior to the Functional Performance Tests. Refer to the project Cx Plan for more details.

1. Coordinate all electrical work with the work of other trades prior to scheduling of any Cx procedures.
2. Coordinate the completion of all electrical testing, inspection, and calibration prior to start of Cx activities.
3. Cx activities shall be scheduled in accordance with project's Cx plan.

1.6 QUALITY CONTROL

A. Incorporate manufacturer's recommended Cx procedures for the systems and equipment to be commissioned under this Section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Equipment to be utilized in the commissioning process shall meet the following requirements:

1. Provide test equipment as necessary for the equipment and systems to be commissioned.
2. Provide testing equipment and accessories that are free of defects and certified for use.
3. Provide testing equipment with current calibration labels per NIST Standards.
4. All testing equipment shall be UL Listed.

PART 3 – EXECUTION

3.1 COMMISSIONING PROCESS REQUIREMENTS

A. Work to be performed prior to commissioning:

1. Complete all phases of the work so the system(s) can be started, tested, adjusted, balanced, and otherwise commissioned.
2. If modifications or corrections to the installed systems are required to bring the system(s) to acceptance levels due to Contractor's incorrect installation or defective materials, such modifications or corrections shall be made at no additional cost to the Owner.

B. Pre-commissioning Responsibilities: Inspection, calibration and testing of the equipment and apparatuses to commission the following systems:

1. Electrical Lighting Systems.
2. Lighting Controls.

C. Commissioning Process Requirements:

1. Refer to Section 01810 General Commissioning Requirements, related sections and Cx Plan for information on meetings, start-up plans, Pre-Functional and Functional Performance Testing (FPT), operations & maintenance data, and other Commissioning activities.

3.2 PREPARATION

A. Provide certified electricians or other qualified personnel as required with tools and equipment necessary to perform all Cx activities.

B. Provide equipment manufacturer's factory representative(s) for commissioning of classrooms lighting and its control system as required by the Cx Plan.

C. Provide certified testing agency personnel and/or report(s) as required in the Cx Plan.

3.3 TESTING

A. Testing documentation shall include the following minimum information:

1. Test number.
2. Equipment used for the test, with manufacturer and model number and date of last calibration.
3. Date and time of the test.
4. Indication of whether the record is the first commissioning test or a retest following correction of a previously identified problem or issue.
5. Identification of the system, subsystem, assembly, or equipment.

6. Conditions under which the test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of the test.

7. Systems and assemblies test results, performance and compliance with contract requirements.

8. Issue number, if any, generated as the result of the test.

9. Name and signature(s) of witnesses and the person(s) performing the test.

B. Test lighting and controls systems performance to verify operation, functionality, light levels, energy usage, and compliance with construction documents.

1. Contractor shall start up, test and document results under the observation of the CxA.

2. Contractor shall execute the Functional Performance Test (FPT) under the observation of the CxA who will record the results of the Functional Performance Test procedures.

3. Equipment & Components to be tested: Refer to Article 3.01, B.

4. Functions and Testing Conditions:
   a. Occupancy sensors and timer controls for lighting:
      1) Verify that all specified functions and features are set up, debugged and fully operable at time of test.
      2) Verify that occupant override feature functions properly and as intended in the contract documents.
      3) Verify that sensor durations are set properly.
      4) Test the sequence of operation for all features and modes and confirm that adjustable timing matches the design specifications and contract documents.
   b. Electric lighting dimming, photocells and controls:
      1) Test the dimming controls during daytime when conditions are such that controls should be dimming electric lighting. Verify that amperage changes in light fixtures are proportional to external light changes. Verify that dimmed light levels at the specified work plane remain within specified limits.
      2) Verify that delays and ramp times are set and functioning so that the speed of change of light fixture output is slow enough to not bother occupants and in compliance with the specifications.
      3) Verify that dimming does not cause lower than specified light levels in adjacent “non-dimmed” spaces.
      4) Verify that the controls and sensors cannot be easily overridden or disabled by occupants.
      5) Verify that dimming systems in places of assembly are interfaced with the Central Fire Alarm system. Dimmed lighting in these areas shall come back to full bright during a fire alarm condition.
   c. Illumination Levels, Night Conditions:
      1) Verify that lighting throughout the building is operating automatically.
      2) Test with doors closed (to simulate actual occupancy) and after finishes are complete.
   d. Illumination Levels, Day Conditions:

1) Verify that lighting throughout the building is operating automatically.

2) Test with doors closed (to simulate actual occupancy), after finishes are complete, and room is furnished.

3) Test at different times during the day, or under Owner-approved simulated conditions, to ensure proper system response and to determine that lighting levels are within specified requirements.

4) Test the system for the different pre-determined settings. AV mode, and normal standard class operation.

e. Lighting Power Density: Perform the test with all interior lighting turned on and any manual or automatic controls temporarily overridden. The lighting power shall be measured at the building's electrical panels. Measurements shall be taken at least one (1) minute after all lighting in the building is on.

f. Emergency Lighting System: Verify that the system operates automatically under any condition, without human intervention, and that it resets back to normal operations after the power failure is over or cleared.

5. Acceptance Criteria:

a. Lighting Controls: For the conditions, sequences and modes tested, the dimming/occupancy/photocell/timing controls, integral components and related equipment respond to changing conditions and parameters appropriately as defined in the Contract Documents.

b. Illumination Levels: Average light levels in the tested space at the work plane elevation shall not be less than 10% below nor greater than 20% above the specified light level range for the space.

c. Lighting Power Density: Average instantaneous lighting power density is +/- 10% of that indicated in the Construction Documents. Power factors on lighting circuits shall be 0.95, or as required by lighting fixture specifications.

6. Sampling Strategy for Identical Units:

a. Lighting Controls: Test all automatic interior lighting controls.

b. Illumination Levels: At least 50% of all space zones and rooms, chosen by the Owner, shall be verified as realizing proper light levels. If 25% of the spaces in the first sample fail the Functional Performance Tests, test another 10% of the untested space zones and rooms (the 2nd sample). If 10% of the spaces in the 2nd sample fail, test all remaining spaces.

c. Power Density: Test all lighting circuits.

C. Contractor shall participate and perform all Cx related testing requirements prescribed under Sections 01810 and the approved project Cx Plan.

3.4 ADJUSTING

A. Systems improperly adjusted, incorrectly installed equipment and/or deficient Contractor performance may result in additional work being required for Cx acceptance.

1. Contractor shall perform all work required to correct installations not meeting contract requirements at no additional cost to the Owner.

B. Corrective work shall be completed in a timely manner to permit completion of the Cx process.

1. Contractor shall refer to the Cx Plan for retesting requirements necessary to achieve required system performance.

2. If the systems' Cx deadline, as defined in the Cx Plan, goes beyond the scheduled completion of Commissioning without resolution of the problem, the Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time switches.

2. Outdoor and indoor photoelectric switches.

3. Indoor occupancy sensors.

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.

1. Interconnection diagrams showing field-installed wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. 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.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.

2. Grasslin Controls Corporation; a GE Industrial Systems Company.

3. Intermatic, Inc.

4. Leviton Mfg. Company Inc.

5. Lightolier Controls; a Genlyte Company.

6. Lithonia Lighting; Acuity Lighting Group, Inc.

7. Paragon Electric Co.; Invensys Climate Controls.

8. Square D; Schneider Electric.

9. TORK.

10. Touch-Plate, Inc.

11. Watt Stopper (The).

12. Or approved equal.

B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Area Lighting Research, Inc.; Tyco Electronics.

2. Grasslin Controls Corporation; a GE Industrial Systems Company.

3. Intermatic, Inc.

4. Lithonia Lighting; Acuity Lighting Group, Inc.

5. Novitas, Inc.

6. Paragon Electric Co.; Invensys Climate Controls.

7. Square D; Schneider Electric.

8. TORK.

9. Touch-Plate, Inc.

10. Watt Stopper (The).

11. Or approved equal.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Lighting.

2. Leviton Mfg. Company Inc.

3. Lithonia Lighting; Acuity Lighting Group, Inc.

4. Novitas, Inc.

5. RAB Lighting, Inc.

6. Sensor Switch, Inc.

7. TORK.

8. Watt Stopper (The).

9. Or approved equal.

B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, and Class 2 power source as defined by NFPA 70.

4. Mounting:

a. Sensor: Suitable for mounting in any position on a standard outlet box.

b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.

c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

6. Bypass Switch: Override the on function in case of sensor failure.

7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.

C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.

E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.

F. Performance Requirements: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as raintight according to UL 773A.

1. Operation: Turn lights on when sensing infrared energy changes between background and moving body in area of coverage; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.

2. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outdoor junction box.

   b. Relay: Internally mounted in a standard weatherproof electrical enclosure.

   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

3. Bypass Switch: Override the on function in case of sensor failure.

4. Automatic Light-Level Sensor: Adjustable from 1 to 20 fc; keep lighting off during daylight hours.

G. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

H. Detection Coverage: Up to 35 feet, with a field of view of 90 degrees.

I. Lighting Fixture Mounted Sensor: Suitable for switching 300 W of tungsten load at 120- or 277-V ac.

J. Individually Mounted Sensor: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.

1. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, and Class 2 power source as defined by NFPA 70.

2. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.

2.4 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 CONTACTOR INSTALLATION

A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.

2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify operation of each lighting control device, and adjust time delays.

B. Lighting control devices that fail tests and inspections are defective work.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Division 26 Section "Network Lighting Controls."

B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION

SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that transformers, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Qualification Data: For testing agency.

E. Source quality-control test reports.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.

C. Source Limitations: Obtain each transformer type through one source from a single manufacturer.

D. 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.

E. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Challenger Electrical Equipment Corp.; a division of Eaton Corp.

2. Eaton Electrical Inc.; Cutler-Hammer Products.

3. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.

4. General Electric Company.

5. Magnetek Power Electronics Group.

6. Siemens Energy & Automation, Inc.

7. Square D; Schneider Electric.

8. Or approved equal.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices except for taps.

1. Internal Coil Connections: Brazed or pressure type.

2. Coil Material: Copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are constructed to withstand seismic forces specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Cores: One leg per phase.

D. Enclosure: Ventilated, NEMA 250, Type 2.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Enclosure: Ventilated, NEMA 250, Type 3R.

1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

F. Transformer Enclosure Finish: Comply with NEMA 250.

1. Finish Color: ANSI 61 gray.

G. Taps for Transformers Smaller Than 3 kVA: None.

H. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

J. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

K. Energy Efficiency for Transformers Rated 15 kVA and Larger:

1. Complying with NEMA TP 1, Class 1 efficiency levels.

2. Tested according to NEMA TP 2.

L. Wall Brackets: Manufacturer's standard brackets.

M. Fungus Proofing: Permanent fungicidal treatment for coil and core.

N. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

O. Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91:

2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems.

B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions, seismic codes applicable to Project, and requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.

1. Uses an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.

2. Perform 2 follow-up infrared scans of transformers, one at 4 months and the other at 11 months after Substantial Completion.

3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.

E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

C. Output Settings Report: Prepare a written report recording output voltage and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under this section.

2. General provisions and requirements for electrical work.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Provide nameplate engraving schedule.

B. Submit engineered settings for each adjustable circuit breaker device, showing the correct time and current settings to provide the coordination within the limits of the specified equipment, per the latest applicable standards of IEEE and ANSI. The information shall be submitted in tabular form and on time current log-log graph paper.

C. Factory Tests: Switchgear tests - ANSI C37.20. Certified copies of design tests, production tests, and conformance tests of the switchgear shall be submitted and review comments shall be received before delivery of equipment to the project site. In lieu of the above tests, a report of these tests previously performed on identical units of each rating will be acceptable.

1.3 APPLICABLE STANDARDS

The switchgear equipment shall be designed, tested and assembled of ANSI, IEEE, and NEMA and UL

1.4 EQUIPMENT QUALIFICATION

The manufacturer of the switchboard shall have a complete technical field service division capable of providing parts and service through a 24-hour, toll-free nationwide dispatch system.

PART 2 - PRODUCTS

2.1 BUSSING

A. Horizontal and vertical busses shall be full length in each equipment section. Buses shall have a minimum withstand rating equal to the available fault current indicated on drawings, but in no case shall the rating be less than 65,000 amperes symmetrical or less than the maximum available short circuit current as provided by the serving utility company.

B. Provide interconnected full capacity neutral bus in each section with the same ratings and construction as the phase busses.

C. Provide interconnected ground bus in each section.

D. Provide space and all hardware and mounting attachments for future devices as indicated on the drawings.

E. Main horizontal bussing shall be full capacity in all switchboard sections.

F. Vertical buss may be tapered, to not less than one third the ampacity rating of the main horizontal buss; but in no case shall the vertical buss be of less capacity than the sum of the frame size ampacities of overcurrent devices mounted in the respective sections including any indicated spares and spaces.

G. The switchboard bussing shall be of sufficient cross-sectional area to meet UL Standard 891 on temperature rise Bus shall be copper with silver plated bus joints. The through bus shall have provisions for the addition of future sections. The through bus supports, connections and joints are to be bolted with grade 5 hex head bolts and Belleville washers to minimize maintenance requirements.

2.2 CIRCUIT BREAKERS

A. General:

1. Circuit protective devices as indicated on the drawings. All devices shall have an interrupting capacity not less than the maximum available fault current at the circuit breaker as indicated on the drawings, but in no case shall the interrupting capacity be less than the maximum available short circuit current as provided by the serving utility company or 65,000 ampere symmetrical. Provide padlock-off devices on each device. Breakers shall provide time overcurrent and instantaneous circuit protection.

2. Circuit breakers shall employ a , quick make-quick break, trip free operating system on each phase, with common trip. Breakers shall comply with UL 489 and NEMA AB1 latest revisions.

3. Provide conductor lugs on circuit breakers to accept conductor sizes shown on drawings.

C. Circuit breakers in the main switchboard with a frame size of 400 amps or less and all circuit breakers in distribution panelboards shall be molded case thermal-magnetic with AIC ratings as herein specified.

D. Circuit breakers and switchboards shall be products of the same manufacturer.

2.3 GROUND FAULT PROTECTION SYSTEM

A. One control power transformer rated 480/120 volts of suitable capacity for shunt tripping of the main circuit breaker and subfeed circuit breakers as indicated on the drawings. Fuse transformer on the 480 volt side.

B. Ground sensor current transformer for each indicated ground fault relay, zero sequence type with integral test winding for each circuit indicated on drawings. (The three phase and neutral

conductor shall be brought through the current transformer window per manufacturer's recommendations).

2.4 DISTRIBUTION SWITCHBOARDS

A. Switchboards shall be floor mounted, dead-front, dead-rear type, front and rear aligned, self-supporting, consisting of one or more vertical sections with group mounted circuit protective devices, instrumentation and control wiring as indicated on the drawings and as specified herein. Switchboards shall comply with UL Standard #UL-891.

B. Distribution switchboards shall include but not be limited to the following:

1. Fully bussed underground pull section (where indicated on the drawings).

2. Main disconnect (where indicated on drawings).

3. Feeder protective devices.

4. Bussing.

5. Provide an additional fully bussed distribution section at the Main Service Entrance Switchboard for connectivity to the future photovoltaic (PV) system.

C. Switchboard sections shall of the universal frame type using die-formed, 12 gauge steel members bolted and welded together. Provide removable side and rear plates with formed edges all around. Provide ventilation openings required to maintain minimum operating temperature. Provide removable steel cover plates for all usable device spaces. Provide lifting means and provisions for moving by means of rollers or skids to installation location. Bolt individual sections together to form a single rigid switchboard assembly. Provide full height, hinged, vertical wireway metal covers, on each vertical wireway, of each distribution section of the switchboard, containing group mounted feeder protective devices.

2.5 CONTROL WIRING

A. Terminal blocks with barriered terminals shall be provided for all control wiring terminator points. Control wiring shall be run in horizontal and vertical, isolated, internal metal wireways and shall be carried across hinges in laced bundles. Wire terminators shall be crimp-on type spade terminal

B. Secondary control wiring shall be minimum of 14 AWG stranded copper type SIS 600 volt insulation.

C. Control circuits shall have circuit number tags at each termination or break in the wire to match circuit numbers on terminal strips and control wiring diagrams.

2.6 WEATHERPROOF SWITCHBOARDS

A. Switchboards indicated as weatherproof (W.P.) or outdoor shall be NEMA 3R, nonwalk-in, tamper resistant construction. Provide full height hinged doors with provisions for padlocking the doors in the closed position.

B. Provide a 250 watt sealed, resistance type, anti-condensation heater in each switchboard section. Heaters shall be controlled automatically by Thermostats and Humidistats. An

overcurrent protective device shall be provided to supply switchboard buss voltage to the heaters, all prewired by the Manufacturer to fused terminals.

C. Switchboard finish shall be elecrostatically applied finish paint over iron oxide primer, 600 hour salt spray test equivalent to ASTM-B-117. Finish color shall be manufacturers standard color, all per ASTM-B-117 600 hour salt spray test equivalent. Provide a 3MIL minimum thickness, undercoating on the bottom six inches of the weather protective housing, inside surfaces.

PART 3 - EXECUTION

3.1 Install switchboards in accordance with manufacturer's written instructions and applicable portions of NECA's "Standards of Installations" for switchboards and motor control centers.

3.2 Switchboards shall be secured to structure in accordance with the Structural Engineer's requirements. Switchboard anchoring shall be designed for a 1.0 gravity lateral acceleration of the equipment.

3.3 TESTING (ADDITIONAL REQUIREMENTS)

Protective device coordination check; adjustable settings shall be set and tested after the equipment installation is complete, for proper operation at set pickup and/or drop-out points, by an independent test laboratory. Testing shall comply with the equipment manufacturers recommendations. Submit three copies of all test results to Architect. Correct any deficiencies and retest.

3.4 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Provide a red and white Bakelite nameplate with 1/2" high letters in each 277/480 volt panel fastened to face of dead-front plate, to read: "WARNING 480 VOLTS, AUTHORIZED PERSONNEL ONLY".

B. Manufacturer shall stencil the equipment name on each device and equipment section to correspond to the identification of the drawing.

C. Devices mounted in equipment controlling protective devices shall be provided with nameplates indicating device controlled or monitored.

D. Provide a copy of the single line diagram, with changes clearly recorded, framed under acrylic, mounted inside the main switchboard.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes distribution panelboards and lighting and appliance branch- circuit panelboards.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail bus configuration, current, and voltage ratings.

4. Short-circuit current rating of panelboards and overcurrent protective devices.

5. Include evidence of NRTL listing for series rating of installed devices.

6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

7. Include wiring diagrams for power, signal, and control wiring.

8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

D. Field quality-control reports.

E. Panelboard schedules for installation in panelboards.

F. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
b. Outdoor Locations: NEMA 250, Type 3R.
c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

4. Directory Card: Inside panelboard door, mounted in transparent card holder.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Mechanical type.

3. Ground Lugs and Bus Configured Terminators: Mechanical type.

4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

5. Or approved equal.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

D. Mains: Circuit breaker.

E. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

G. Branch Overcurrent Protective Devices: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

5. Or approved equal.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.

1. External Control-Power Source: 120-V branch circuit.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:

    a. Instantaneous trip.

    b. Long- and short-time pickup levels.

    c. Long- and short-time time adjustments.

    d. Ground-fault pickup level, time delay, and I^2t response.

4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).

6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

    a. Standard frame sizes, trip ratings, and number of poles.

    b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

    c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

    d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

    e. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."

    f. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

    g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handles in on position.

    h. Handle Clamp: loose attachments, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.

1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

F. Install filler plates in unused spaces.

G. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

I. Comply with NECA 1.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

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SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.

2. Twist-locking receptacles.

3. Receptacles with integral surge suppression units.

4. Wall-box motion sensors.

5. Snap switches and wall-box dimmers.

6. Solid-state fan speed controls.

7. Wall-switch and exterior occupancy sensors.

8. Communications outlets.

B. Related Sections include the following:

1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. 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.

C. Comply with NFPA 70.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).

2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).

3. Leviton Mfg. Company Inc. (Leviton).

4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

5. Or approved equal.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex).

b. Hubbell; HBL5351 (single), CR5352 (duplex).

c. Leviton; 5891 (single), 5352 (duplex).

d. Pass & Seymour; 5381 (single), 5352 (duplex).

2.3 GFCI RECEPTACLES

A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; GF20.

b. Pass & Seymour; 2084.

2.4 TWIST-LOCKING RECEPTACLES

A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; L520R.

b. Hubbell; HBL2310.

c. Leviton; 2310.

d. Pass & Seymour; L520-R.

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).

b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).

c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).

d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

C. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 2221L.

b. Hubbell; HBL1221L.

c. Leviton; 1221-2L.

d. Pass & Seymour; PS20AC1-L.

3. Description: Single pole, with factory-supplied key in lieu of switch handle.

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995.

b. Hubbell; HBL1557.

c. Leviton; 1257.

d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 1995L.

b. Hubbell; HBL1557L.

c. Leviton; 1257L.

d. Pass & Seymour; 1251L.

2.6 OCCUPANCY SENSORS

A. Wall-Switch Sensors:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 6111 for 120 V, 6117 for 277 V.

b. Hubbell; WS1277.

c. Leviton; ODS 10-ID.

d. Pass & Seymour; WS3000.

e. Watt Stopper (The); WS-200.

2. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; AT120 for 120 V, AT277 for 277 V.

b. Leviton; ODS 15-ID.

c. Wattstopper

d. Novitas Inc.

3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft.

C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Hubbell; ATP1600WRP.

b. Leviton; ODWWV-IRW.

c. Watt Stopper (The); CX-100.

d. Novitas Inc.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft.

2.7 COMMUNICATIONS OUTLETS

A. Data Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3560-6.

b. Leviton; 40649.

3. Description: (2) RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6. Comply with UL 1863.

B. Combination TV and Power Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

2. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper; 3562.

b. Leviton; 40595.

3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 6; and one Type F coaxial cable connector.

2.8 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: Satin-finished stainless steel, 0.04-inch-thick.

3. Material for Unfinished Spaces: Galvanized steel, smooth, high-impact thermoplastic.

4. Material for Damp Locations: Thermoplastic and Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum and thermoplastic with lockable cover.

2.9 MULTIOUTLET ASSEMBLIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.

2. Wiremold Company (The).

C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

D. Raceway Material: Metal, with manufacturer's standard finish, PVC.

E. Wire: No. 12 AWG.

2.10 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring Devices Connected to Normal Power System: Gray, Ivory, White, As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.

2. Isolated-Ground Receptacles: Orange.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

4. Existing Conductors:

a. Cut back and pigtail, or replace all damaged conductors.

b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served. Engraved with panelboard name and circuit number.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.

2. Test Instruments: Use instruments that comply with UL 1436.

3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.

2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.

3. Ground Impedance: Values of up to 2 ohms are acceptable.

4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches panelboards, switchboards, enclosed controllers and motor-control centers.

2. Spare-fuse cabinets.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.

b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

3. Current-limitation curves for fuses with current-limiting characteristics.

4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.

5. Coordination charts and tables and related data.

6. Fuse sizes for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Ambient temperature adjustment information.

2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.

4. Coordination charts and tables and related data.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

E. Comply with UL 248-11 for plug fuses.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

5. Or approved equal.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

2. Finish: Gray, baked enamel.

3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.

4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:

1. Service Entrance: Class L, fast acting Class L, time delay Class RK1, fast acting Class RK1, time delay Class J, fast acting Class J, time delay Class T, fast acting.

2. Feeders: Class L, fast acting Class L, time delay Class RK1, fast acting Class RK1, time delay Class RK5, fast acting Class RK5, time delay Class J, fast acting Class J, time delay.

3. Motor Branch Circuits: Class RK1 Class RK5, time delay.

4. Other Branch Circuits: Class RK1, time delay Class RK5, time delay Class J, fast acting Class J, time delay.

5. Control Circuits: Class CC, fast acting time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

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. Section Includes:

1. Fusible switches.

2. Nonfusible switches.

3. Molded-case circuit breakers (MCCBs).

4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.

2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Manufacturer's field service report.

G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.

2. Altitude: Not exceeding 6600 feet.

B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than seven days in advance of proposed interruption of electric service.

2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Architect's written permission.

4. Comply with NFPA 70E.

1.8 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

5. Or approved equal.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

4. Hookstick Handle: Allows use of a hookstick to operate the handle.

5. Lugs: Mechanical type, suitable for number, size, and conductor material.

6. Service-Rated Switches: Labeled for use as service equipment.

7. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac 120-V ac.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

5. Or approved equal.

B. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.

2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.

3. Hookstick Handle: Allows use of a hookstick to operate the handle.

4. Lugs: Mechanical type, suitable for number, size, and conductor material.

5. Accessory Control Power Voltage: Remote mounted and powered; 24-V ac 120-V ac.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.

4. Square D; a brand of Schneider Electric.

5. Or approved equal.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.

2. Long- and short-time pickup levels.

3. Long- and short-time time adjustments.

4. Ground-fault pickup level, time delay, and I^2t response.

F. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

G. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

H. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.

5. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."

6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

8. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.

9. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

11. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.

12. Electrical Operator: Provide remote control for on, off, and reset operations.

13. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.4 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

2. Outdoor Locations: NEMA 250, Type 3R.

3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

D. Acceptance Testing Preparation:

1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. Perform the following infrared scan tests and inspections and prepare reports:

a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.

b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.

c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION

SECTION 26 50 00

LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. Work Included:

All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specification sections and drawings for related work required to be included as work under Division Sixteen.

2. General provisions and requirements for electrical work.

1.3 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. General

1. Submit certification letter from manufacturers of Lamps and Ballasts, stating the specific lamp and ballast combination comply with manufacturer recommendation and approval for the combined use, shown on the drawings.

2. Provide complete manufacturers catalog data information for each light fixture (luminaire), ballast, lamp, materials, auxiliary equipment/devices, finishes and photometrics.

B. Performance Certification

1. Submit manufacturer's certified lamp and ballast tests report data showing compliance with contract document.

2. Submit manufacturer's letter of certification for each fixture type, confirming the proposed combination of specific lamp, ballast and auxiliary components for each light fixture (luminaire)type will function together correctly and perform in compliance with the requirements of the contract documents as follows:

"The proposed lamp(s), lamp ballast(s)(where, applicable), lamp sockets and fixture have been tested as an assembly. The proposed fixture products assembly are certified by the manufacturer to function within the required temperature, lumen output, electrical characteristics and operational life described in the contract documents".

C. Light Fixture Samples

1. If requested by the OWNER'S Representative, provide a sample of each fixture proposed as a substitution for a specified fixture. Sample fixture shall be complete with specified lamps, 3 wire grounding "SO" cord and plug for 120-volt 60 Hz, AC plug-in operation. Sample fixtures shall be delivered to the OWNER'S Representative's office for review, the samples shall be picked up within ten (10) working days after review comments have been received; any samples left beyond this time will be discarded by the OWNER'S Representative. Decision of OWNER'S Representative regarding acceptability of any lighting fixture is final.

1.4 QUALITY ASSURANCE (ADDITIONAL REQUIREMENTS)

A. Work and materials shall be in full accordance with the latest rules and regulations as follows. The following publications shall be included in the Contract Document requirements. If a conflict occurs between the following publications and any other part of the Contract Documents, the requirements describing the more restrictive provisions shall become the applicable contract definition:

1. U.L. – Underwriters' Laboratory

   a. U.L. – 8750: Light Emitting Diode (LED) and LED drivers

2. NEMA-LE4

3. United States Federal Government

   a. FCC – Part 18: EMI and RFI emissions limitations.

   b. EPA: Energy conservation publications and waste disposal regulations.

4. ETL and C.B.M. certified and approved.

5. Electrical installation standards, National Electrical Contractors' Association:

   a. NEIS/NECA Recommended Practice for

      & IESNA – 500: Installing Indoor Commercial Lighting Systems.

   b. NEIS/NECARecommended Practice for

      & IESNA – 501: Installing Exterior Lighting Systems.

   c. NEIS/NECA Recommended Practice for

      & IESNA – 502: Installing Industrial Lighting Systems.

6. Illuminating Engineering Society – IES:

   a. IES – LM41: Photometric and Reporting

   b. IES – 587: Transient Surge Protection

7. American National Standards Institute:

   a. ANSI – C81

b. ANSI – C82

c. ANSI – C62.41: Transient Withstand

d. ANSI – C78: Lamps

8. State California

Code of Regulations

Title-24: Energy Code

PART 2 - PRODUCTS

2.1 GENERAL

A. Complete Fixture

1. Provide light fixtures complete including lamps, ballasts, lamp holders sockets, housings, ceiling and wall trim "rings" for each ceiling type, mounting and adapter support brackets, diffusers/lenses and outlet boxes.

2. Include an allowance of $300.00 to provide a light fixture for each lighting fixture outlet shown on drawings without a fixture type designation.

B. Specific Fixture Requirements and Fixture Schedule Information

1. The catalog numbers included in the description of the various types of lighting fixtures shall be considered to establish the type or class of the fixture with a particular manufacturer only. The fixture length, number of lamps and lamp types, component materials, accessories, mounting type, ceiling, wall and install adapters, operation voltage, and all other components required to fulfill the total description of the fixture based on all drawing information, branch circuits, voltages, specification information, and shall be included in the contract requirements regardless of whether or not the catalog number specifically includes these components.

2. Lighting fixtures shall be the types as indicated in fixture schedule on the drawings and as described in the specifications.

3. All fixtures of the same fixture type shall be the same manufacturer and of identical finish and appearance, unless indicated otherwise on drawings.

C. Manufacturer Certification of Operation

1. Lamps and lamp ballasts shall be recommended and certified by the respective manufacturer(s), to be "matched" to operate correctly together, within the published characteristics, for efficacy, lamp starting, operating life hours, lumen output, power factor, power input, operating line ampere, sound intensity, and temperature.

2.2 LAMPS

A. General

1. Lamps shall be new, of wattage and type indicated. Each fixture or lighting outlet shall be supplied with the proper lamp(s)

2. Lamps shall comply with the characteristics as described in the lamp tables below, except where indicated otherwise on the drawings.

3. Lamps shall comply with limits on mercury and classification as non-hazardous waste as follows:

   a. Federal EPA – Toxicity Characteristics Leaching Procedures (TCLP).

   b. State of California – Total Threshold Limit Concentration (TTLC).

   4. Lamps shall be as manufactured by General Electric, Philips, Osram or Sylvania.

2.3 LIGHT FIXTURES (LUMINAIRES)

A. General

1. Lighting fixtures shall have all parts, ballasts, sockets, support attachments, trim flanges and fittings necessary to complete and properly install the fixture at the indicated installation locations. All fixtures shall be provided with lamps of size and type specified.

2. Ceiling and/or wall surface mounted lighting fixtures shall not have any exposed chase nipples or conduit knockouts visible to view within fixture housing. Lighting fixtures mounted in continuous rows shall have chase nipples or conduit knockouts between lighting fixture housing, but shall not have visible chase nipples/conduit knockouts on the visible ends of the continuous row of lighting fixtures.

3. Where fixture color is indicated to be selected by the ARCHITECT and/or OWNER'S Representative, provide two color chip samples for each color for review.

4. Recessed fixtures with attached junction box shall be provided with a junction box permanently attached to the plaster ring so that the junction box is accessible through the fixture opening when the fixture is removed. Connection between fixture and pull box shall be flexible metal conduit with not less than 16 AWG "AF" or "CF" type fixture rated copper wires, high temperature wire insulation for not less than 600 volts A.C. The flexible conduit shall be sufficient length, so that when the fixture is removed, the pullbox is readily accessible.

5. Recessed fixtures shall be Underwriters' Laboratory approved for recessed installation with plaster frame and attached pull box. Lamp enclosure, reflectors and finish wiring shall not be installed until plastering is completed. Exposed finish trim shall not be installed until finish painting of the adjacent surface is completed.

6. The fixture shall bear Underwriters' Laboratory label of approval for the wattage and installation indicated.

7. Light fixtures installed outdoors, in damp or wet locations shall be U.L. labeled for said location as "damp-location" and "wet-location" for the respective installation location.

8. Fixtures in contact with thermal/building insulation, shall be UL listed and rated for direct contact installation in thermal insulation systems.

9. Lamp auxiliary support brackets shall be heat-resistant, non-dielectric. Alternatively, metal auxiliary lamp support brackets shall be electrically isolated from the fixture, to prevent glass decomposition.

10. Lighting fixtures installed in masonry and/or concrete construction. The fixture housing shall be rated for "concrete-pour" installation location.

11. Provide a permanent label inside each light fixture stating the following relamping information. Not less than 0.125-inch high black alphanumeric characters on white background.

"Replacement lamp(s) installed in this light fixture _must comply with the following criteria:

*: CRI *: Lamp Watts

*: CCT-K *: Lamp Lumens

Only lamp rated * type lamp ballast shall be installed in this fixture."

*Insert the value required for the specific lamp required by the Contract Documents for each light fixture.

B. Lens and Diffusers

1. Acrylic plastic or Plexiglas for the light fixture diffusers or fixtures lenses, shall be 100-percent virgin material.

2. Thickness of not less than 0.125-inch, as measured at the "THINIST" portion on the diffuser or lens. However, thickness shall be increased to sufficient construction and camber to prevent the lens and diffusers from having any noticeable sag over the entire normal life of the installation.

3. Diffusers shall be formed from cast sheet by a vacuum and/or pressure technique.

4. Lighting fixtures containing lamps with Dichroic reflectors and light fixtures with non-Dichroic lens/diffuser, shall be rated for high temperature lamp operations resulting from lamp heat redirected (reflected) back into the fixture.

C. Fixture/Luminaire Internal Wiring

1. Provide wiring between fluorescent lampholders and associated operating and starting equipment. Provide ballasts/transformers inside lighting fixture.

2. Wire insulation for ballast/lamps employing igniters, shall be rated and U.L. listed for the igniter pulse voltage.

PART 3 EXECUTION

3.1 LIGHT FIXTURE INSTALLATION

A. General

1. The CONTRACTOR shall verify actual ceiling and wall construction types as defined on the Architectural drawings and furnish all lighting fixtures with the correct mounting devices, trim rings, brackets whether or not such variations are indicated by fixture catalog number. The CONTRACTOR shall verify depth of all recessed lighting fixtures with Architectural drawings prior to ordering fixtures. Any discrepancies that would cause recessed lighting fixtures not to fit into ceiling shall be reported to the OWNER'S Representative prior to release of order to the supplier of the fixtures.

2. On acoustical tile ceilings, fixture outlets shall be accurately located in the center, at the intersection of the four corners or at the center of the joints of two tiles.

3. The CONTRACTOR shall aim the exterior adjustable lighting fixtures after dark in the presence of, and at a time convenient to the OWNER'S Representative.

4. Fixtures shall be ordered and furnished to operate correctly on the branch circuit voltage connected to the respective fixture as shown on the site plan and floor plan electrical drawings. The voltages shown on the fixture schedule are for generic fixture information only.

5. Install and connect lighting fixtures to the circuits and control sequences indicated on the drawings and to comply with respective manufacturer's instructions/recommendations.

B. Lighting fixtures installed in ceiling support grids - suspended lay-in "T-bar" and concealed spline ceilings.

1. Provide two seismic clips at opposite ends of each recessed light fixture, the clip shall connect to the ceiling grid main runners and the light fixture. The light fixture with seismic clips and ceiling grid runner connections shall resist a horizontal seismic force equal to the total weight of the light fixture assembly.

2. Each light fixture weighing 40 pounds or less and where the respective ceiling grid system is "heavy duty" type, shall be suspended directly from the ceiling grid or shall be suspended independent of the ceiling grid support system as approved by the AHJ. Each light fixture weighing more than 40 pounds or where the ceiling grid system is not a "heavy duty" type, shall be supported independent of the ceiling grid and independent of ceiling grid support system.

3. Each light fixture supported independent of the ceiling grid system shall be supported with a minimum of four taut independent support wires, one wire at each fixture corner.

4. Each light fixture supported directly from the ceiling grid or ceiling grid support system shall be additionally connected with a minimum of two independent slack safety support wires. One wire at each opposite diagonal fixture corner. Each 3 ft. x 3 ft. and larger light fixture shall be supported in the same manner, except provide a minimum of four independent slack safety wires, one at each fixture corner.

5. Light fixtures surface mounted to a suspended ceiling shall be installed with a one and one-half inch steel – "C" channel which spans across and above a minimum of two parallel main ceiling grid "runners" and concealed above the ceiling. Each channel or angle member shall be provided with a minimum of two threaded studs for attaching to the fixture housing through the lay-in ceiling tile. Two steel "C" channel members shall be installed for each four-foot (or smaller) fixture. Install the channels within six inches of each end of the light fixture to span a minimum of two ceiling grid parallel main runners. Provide two seismic clips connecting the ceiling grid main runners to each steel – "C" channel. Provide a not less than two (2) taut independent support wires connecting to each channel. Bolt the light fixtures to the threaded studs on the channels or angles, to support the light fixture tight to the ceiling surface.

C. Fixture Supports

1. The support wires for light fixture support shall be 12-gauge steel (minimum). The wires including their building and light fixture attachments shall provide support capacity of not less than four times the weight of the light fixture assembly. Provide additional light fixture support wires and building anchors to meet these requirements, as part of the contract. The support wires shall be anchored to the building structural elements above the ceiling.

2. Suspended fixtures weighing in excess of 40 pounds shall be supported independently of the fixture outlet box. Provide "air craft" (minimum 12 gauge) steel hanger cable for suspended fixtures route cable concealed or in pendant where possible. Each cable attachments shall support four times the weight of the fixture assembly. Securely attach the cable to the building structure.

3. Surface mounted fixtures installed on drywall or plaster ceilings and weighing less than 40 pounds may be supported from outlet box. Provide structural supports above drywall or plaster ceilings for installation of fixtures weighing more than 40 pounds and secure fixture to structural supports. The use of toggle bolts is prohibited.

D. Recessed Lighting Fixtures - Fire Rated Building Surfaces

1. Lighting fixtures recessed in ceiling or wall which has a fire resistive rating of 1 hour or more shall be enclosed in a fully enclosed backbox (except over fixture lens/diffuser). The material used to fabricate the "enclosed backbox" shall have a fire rating equal to that of the respective ceiling or wall.

2. The space from the fixture to the box enclosure shall be a minimum of 3-inches.

3. The backbox shall be concealed behind the fire rated ceiling and wall finish surface. The light fixture shall be provided with lamp ballast rated for (normal light output) operation in a "high" ambient temperature.

3.2 LAMPS

A. Lamps shall be the type and manufacturer as recommended by the dimming system manufacturer.

B. Install all lamps in each light fixture.

D. Lamp and light fixture use during construction:

1. All lamps in lighting fixtures that have been operated (ON) for a total of more than 300 hours prior to final completion of the contract notice of completion, shall be relamped by the CONTRACTOR. Remove the existing lamps with more than 300 hours of illuminated operation and provide new lamps of the type required by the contract documents, install lamps in respective light fixtures, typical for the following lamp types:

a. Light Emitting Diode (LED).

3.3 LENS AND DIFFUSERS

A. Lens, diffusers, internal reflectors shall be completely cleaned of all dust, dirt and fingerprints after the installation of the light fixtures and lamps, and after all trades have completed work and prior to occupancy of the facility by the OWNER.

3.4 BALLASTS

A. Ballasts remote from the lighting fixture, mounted as shown on the drawings and designed for remote operation. Additional wiring and conduit shall be provided whether shown on the drawing or not, between lighting fixture and remote Ballasts with required quantity of "THHN" wire installed in conduit to operate said fixture(s).

B. Provide proper type and quantity of conductors with conduit system for proper operation of dimming system, whether or not shown on drawings.

3.5 COMMISSIONING LIGHTING FIXTURES (ADDITIONAL REQUIREMENTS)

A. General

1. Verify correct lighting control configurations and operation in each room.

2. Simulate normal source power failure by "opening" (turn off) building main service disconnect and verify connections and operation of each emergency lighting fixture.

3. Confirm "EXIT" sign directional arrows are visible in each "EXIT" sign.

4. Verify light fixture support-hangers, ceiling grid clips and seismic restraints comply with the Contract Documents.

5. Remove protective shipping/installation shields on fixtures. Verify fixtures and lamps are clean and free of construction debris. Clean light fixtures found to be contaminated or dirty.

6. Setup, program and function test lighting control systems to perform each of the indicated control functions, area/room zones and sequences.

B. Sample spot-check in each room the following lighting fixture information:

1. Lamp type and performance data.

2. Ballast type and performance data.

3. Combined lamp/ballast certification of performance and compatibility by respective manufacturer.

4. Verify instructional signage is placed inside each lighting fixture in compliance with Contract Documents.

END OF SECTION

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SECTION 26 51 00

INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.

2. Exit signs.

3. Lighting fixture supports.

B. See Division 26 Section "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

C. See Division 26 Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.3 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

D. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. 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.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

3. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.

4. Laminated Silver Metallized Film: 90 percent.

F. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.

b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

2.3 EXIT SIGNS

A. Internally Lighted Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.

2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.

2.4 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Comply with NFPA 70 for minimum fixture supports.

C. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.

E. Adjust aimable lighting fixtures to provide required light intensities.

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 265213

EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Emergency lighting.
2. Exit signs.
3. Luminaire support components.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.

1. Include data on features, accessories, and finishes.
2. Include physical description of the unit and dimensions.
3. Battery and charger for light units.
4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.

a. Testing Agency Certified Data: For indicated **luminaires**, photometric data certified by a qualified independent testing agency. Photometric data for remaining **luminaires** shall be certified by manufacturer.
b. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule:

1. For emergency lighting units. **Use same designations indicated on Drawings.**
2. For exit signs. **Use same designations indicated on Drawings**.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
4. Structural members to which equipment will be attached.
5. Size and location of initial access modules for acoustical tile.
6. Items penetrating finished ceiling including the following:

a. Other luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

7. Moldings.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Provide seismic qualification certificate for each piece of equipment.

E. Product Test Reports: For each luminaire for tests performed by **manufacturer and witnessed by a qualified testing agency**.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: **1 for every 10** of each type and rating installed. Furnish at least one of each type.
2. Luminaire-mounted, emergency battery pack: One for every **20** emergency lighting units. Furnish at least one of each type.

3. Diffusers and Lenses: **One for every 10** of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: **Luminaire manufacturer's laboratory** that is accredited under National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

C. Mockups: For interior luminaires in room or module mockups, complete with power and control connections.

1. Obtain Architect's approval of luminaires and signs in mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Two** year(s) from date of Substantial Completion.

B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Power Unit Batteries: **Five** years from date of Substantial Completion. Full warranty shall apply for **the entire warranty period**.
2. Warranty Period for Self-Powered Exit Sign Batteries: **Five** years from date of Substantial Completion. Full warranty shall apply for **the entire warranty period**.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified **and the luminaire will be fully operational during and after the seismic event**."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Bulb Shape: Complying with ANSI C79.1.

E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body **and compatible with ballast**.

1. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

    a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
    b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
    c. Humidity: More than 95 percent (condensing).
    d. Altitude: Exceeding 3300 feet (1000 m).

2. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

3. Battery: Sealed, maintenance-free, **nickel-cadmium** type.
4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
5. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.3 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: As indicated on Lighting Fixture **Schedule**, with the following additional features:

    a. Operating at nominal voltage of **277 V ac**.
    b. **Internal** emergency power unit.
    c. Rated for installation in damp locations, and for sealed and gasketed luminaires in wet locations.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Operating at nominal voltage of **120 V ac**.
2. Lamps for AC Operation:
    a. LEDs; 50,000 hours minimum rated lamp life.

3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Support Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, **12 gage (2.68 mm)**.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.

E. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **wire support** for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Perform startup service:

1. Charge **batteries** minimum of one hour and depress switch to conduct short-duration test.
2. Charge **batteries** minimum of 24 hours and conduct one-hour discharge test.

3.6 ADJUSTING

A. Adjustments: Within **12** months of date of Substantial Completion, provide on-site visit to do the following:

1. Inspect all luminaires. Replace lamps, **batteries,** or luminaires that are defective.

a. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

2. Conduct short-duration tests on all emergency lighting.

END OF SECTION

SECTION 27 05 00

COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.

2. Sleeves for pathways and cables.

3. Sleeve seals.

4. Grout.

5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping and conduit installed at required slope.

4. So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.

b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.

b. Calpico, Inc.

c. Metraflex Co.

d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 27 10 00

STRUCTURED CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specifications sections and drawings for related work required to be included as work under this section.

2. General provisions and requirements for electrical work.

B. Provide computer cabling system for the new buildings. System shall include fiber optic cables, copper cables, intermediate distribution frames, racks, connectors, accessories, testing, and extended manufacturer's 15-year warranty as described herein and as follows:

1. Provide an Intermediate Distribution Frame (IDF) where indicated on plans.

2. Utilizing the conduit system indicated on the plans, provide a minimum 12 strand, 50/125 multimode OSP fiber optic cable from the MDF in the main LAN room to each of the IDF's indicated on plans.

3. Provide a minimum of two (2) copper wire connectors at each computer outlet shown on plans. Utilizing conduits and raceways indicated on the plans, provide copper 4-pair Category-6 unshielded twisted pair cable from each connector to the designated IDF.

4. Provide Fiber Optic Distribution Enclosures at MDF and at each IDF. Provide copper wire patch panels and accessories at each new IDF location where required.

5. Provide a 50-pair cable from the Main Telephone backboard in the Main LAN room to each telephone backboard indicated on the plans.

1.3 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit block wiring diagrams showing MDF, IDF's, Category-6 outlets, and interconnecting cables and connectors.

B. Submit manufacturer's standard catalog data for each component.

C. Submit six (6) copies of the manufacturer's certifications for each installer performing the work. The submittal shall be approved by the OWNER'S REPRESENTATIVE prior to initiating any related contract work.

D. Submit system extended warranty statements from manufacturer.

E. Provide a reference list of at least 10 public works projects, similar in nature to this one, that the contractor has completed in the past three years. Provide customer name, general contractor and phone number (if work done as a sub-contractor), general scope of work, contract amount, contact person and phone number.

F. Submit proposed labeling system for cables and outlets.

1.4 APPLICABLE STANDARDS

A. The equipment shall be UL listed, labeled, and approved for the application shown in the contract documents.

B. The complete system material, equipment, testing, installation and workmanship shall comply with requirements of:

1. This Technical Specification and Associated Drawings

2. ANSI/EIA/TIA-568 Commercial Building Wiring Standard - July 1991, and Standards Proposal No. 2840-A, Proposed Revision of EIA/TIA-568 Commercial Building Cabling Standard (published as TIA/EIA-568-A)

3. EIA/TIA-TSB-36 Technical Systems Bulletin, Additional Cable Specifications for Unshielded Twisted-Pair Cables - November, 1991

4. TIA/EIA-TSB-40 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair Connecting Hardware - January, 1994

5. TIA/EIA-TSB-75 Telecommunications Systems Bulletin, Additional Transmission Specifications for Unshielded Twisted-Pair consolidation points and cabling - January, 1997

6. ANSI/EIA/TIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces - October 1990

7. ANSI/EIA/TIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - February 1993

8. ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications - August, 1994

9. Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) - 1996

10. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) -1997

C. The completed computer/data system shall provide electronic data/network multi-channel communications for the following:

1. IEEE 802.3/ETHERNET, 10 Mbps 10Base-T and 150Mbps 100Base-Tx and 350 Mbps per draft compliant for copper wire; 100Base-Fl and 1000Base-FX for fiber optics.

D. This document describes a system to be installed in accordance with recognized telecommunications industry cabling standards. Although the intent of the standard is to provide an application independent cable system, one or more of the following documents, describing specific network types and topologies, may be pertinent to the overall operation of the system and should be considered associated reference materials.

1. ISO/IEC 8802-3 (IEEE 802.3)

2. ANSI ANSI X3T9.5 Fiber Distributed Data Interface (FDDI) Physical Medium Dependent (PMD)

3. ANSI ANSI X3t9.5 Twisted Pair Physical Medium Dependent (TP-PMD)

1.5 EQUIPMENT QUALIFICATIONS

A. The supplier of the equipment shall be the factory authorized distributor and service facility for the brands of equipment provided.

B. Extended Material and Performance Warranties.

1. The contractor shall facilitate a warranty between the manufacturer and the Owner that provides coverage of the installed cabling. An extended component and performance warranty shall be provided which warrants functionality of all components used in the system for a minimum of fifteen years from the date of acceptance. All fiber cable, copper cable, fiber termination hardware and housings, copper termination hardware and trim shall be of one manufacturer to ensure the owner can establish one relationship for the warranty. A performance warranty of 15 years shall also be provided which warrants the installed 350 MHz horizontal copper and for both the horizontal and Gigabit backbone optical fiber portions of the cabling system. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA SP-2840A, Annex E. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA SP-2840A, Annex H. Installers shall be factory trained technicians with a factory trained supervisor overseeing the project.

2. Warranty scope includes network cables and terminations, network workstation plug-in outlets, and patch panel plug-in outlets, cable splices and connectors, racks, cabinets and enclosures.

3. Repair or replace the defective material at the project premise, to comply with the performance standards outlined in the contract documents during the warranty period.

C. The system shall be as manufactured by Amp or approved equal.

1.6 ABBREVIATIONS

Abbreviation	Terminology
dB	Decibel
dBm	Decibel referenced to a milliwatt
ft.	Feet
GHZ	Gigahertz
KM	Kilometer-lKM
kpsi	1000 pounds per square inch
m	Meter=39.37 inches
Mbps	Megabits per second
Mhz	Megahertz
micron	Micrometer
mm	Millimeter=l0-3 meter
NEXT	Near end cross talk
nm	Nanometer=10-9 meter
pF	Picofarad=10-12 farad
STP	Shielded twisted pairs copper wire
ScTP	Shield Screened twisted pairs copper wire
um	Micrometer=10-6 meter
MDF	Main Distribution Frame
IDF	Intermediate

PART 2 - PRODUCTS

2.01 FIBER OPTICS CABLES

A. Fiber optic cables optical fibers, (90/125) graded index single and multimode optical glass fibers, 90 micron fiber core and 125 micron fiber cladding, 0.275 numerical aperture. Optical fibers shall be 100 kpsi proof tested, with maximum 0.7 micron flaw size for dual operation at 850nm and 1300nm wave lengths. Operating temperature range - 20 degrees centigrade through +60 degrees centigrade. Cables shall be flame retarding.

B. Multimode Strands

a. Minimum bandwidth:

@ 850nm - wave length 160MhZ per KM length

@ 1300nm - wave length 500MhZ per KM length

b. Maximum attenuation:

@ 850nm- wave length 3.5 dB @ 1 KM length

@ 1300nm - wave length 1.5 dB @ 1 KM length

C. Suitable for use with the following systems and protocols:

1. IEEE 802.5 TOKEN RING 4Mbps and 16Mbps.

2. IEEE 802.3 ETHERNET - 10Mbps 10Base-T and 100Mbps 100Base-Tx, 1000Base-Fx.

D. Each fiber shall be individually identified with factory color coding or factory imprinted label. The outer cable jacket shall be imprinted with date, manufacturer's model and catalog number, along with agency listing identification. All fiber optic cable shall be produced by the same manufacturer.

E. Optical fiber cables used outside or below grade shall be housed in an OSP loose tube, gel-filled, construction jacket configuration. Inside fiber shall be riser or plenum (as conditions require) tight buffered. OSP loose tube, gel-filled fiber cable that will have at least 50 feet inside a building (from point of entry to point of the connector or point of exit) shall be inside/outside rated.

F. Each optical fiber component shall be surrounded by an individual aramid yarn strength member.

G. Optical fiber cable shall withstand a minimum short-term tensile load of 105 pounds without damage to the optical fiber.

H. Optical fiber cable shall be able to withstand a minimum bend radius of 45 millimeters (mm) during installation without damage to the optical fiber elements.

I. Optical fiber cable shall have a minimum crush resistance of 200 N/cm.

J. Loose tube fiber cables shall have breakout and furcation kits installed, for every tube and fiber, at both ends of termination of every link.

K. Fiber shall be an manufactured by Corning, Berk-Tek, General Cable or approved equal.

2.02 COPPER WIRE CABLES (TWISTED PAIRS)

A. Conductors shall be copper wire, individually insulated and color coded, with multiple conductors in twisted pairs. An overall non-conductive jacket shall encase the copper wires.

B. Cables shall be UL listed Category-6 complying with National Electrical Code, ETL tested and certified to comply with or exceed N.E.C. - CL2P or CL3P. The outer cable jacket shall be imprinted with date, manufacturer model and catalog number and agency listing identification.

C. Characteristics:

1. Wire size 4AWG solid copper

2. Quantity of twisted pairs Four (4)

3. Equal to CAT6

D. Copper cable shall be an manufactured by Berk-Tek, General Cable or approved equal.

2.03 FIBER OPTIC FIBER CONNECTORS

A. Fiber optic connectors shall be SC-style connectors.

B. Connectors shall incorporate zircona ceramic ferrules. The same type shall be used throughout the installation. Provide dust cover cap for each connector.

C. All connectors provided by the Contractor shall be of the same manufacturer and part number throughout this contract.

D. Fiber optic connectors shall be rated for a mean loss not greater than 0.3 dB per mated pair.

2.04 COPPER WIRE CONNECTORS FOR PATCH PANELS, COMPUTER OUTLETS AND TELEPHONE OUTLETS

A. Connectors shall comply with FCC part 68 Subpart F for gold plating. Connectors shall be UL listed and shall comply with UL94V-0

B. Provide a removable blank dust cover for each plug-in outlet insert. The dust cover shall protect the insert from contamination until a workstation or patch cord is "plugged" into the outlet.

C. Copper wire outlet connectors shall be color coded orange to distinguish telephone/voice separately from computer/data. Leviton extreme series or equal.

D. Provide mounting straps compatible with the outlet box, floor box, and/or surface raceway containing the connectors.

E. Ethernet – 8 position female modular jack RJ style complying with ANSI/EIA/TIA 568a for Category 6 data rate.

F. Computer/data and telephone universal outlet connector performance requirements based on ANSI/ETA/TIA-568a Category 6 standards for the complete assembly.

2.05 FIBER OPTIC DISTRIBUTION ENCLOSURES (ATDU)

A. The ATDU enclosure shall mount in a EIA standard 19 inch wide enclosed or open frame equipment rack assembly. The ATDU enclosure shall be metal, painted finish, manufacturers standard color. The ATDU shall provide the following self-contained functions internal to the ATDU assembly.

1. Fiber cable termination.

2. Fiber cable patch panel.

3. Fiber cable management, training and strain relief.

4. Individual fiber and patching port identification numbers, color coding of incoming trunk and out-going distribution fiber ports.

B. Fiber cable patch panels shall be metal with patch ports for each fiber to be terminated at the ATDU.

2.06 COPPER WIRE PATCH PANELS

A. Standard EIA 19" wide metal panel, manufacturers standard color. Prepunched for copper wire outlet connectors. Panel shall mount on a EIA standard 19 inch wide enclosed or open frame equipment rack assembly.

B. The copper wire connector installed in the patch panel shall be the same configuration, manufacturer and type as the corresponding copper wire connector

PART 3 - EXECUTION

3.01 CABLE INSTALLATION

A . Cables connecting to equipment racks shall be installed with not less than six feet of slack cable between the equipment rack/terminal block and terminal backboard. The slack cable shall be coiled and supported on the backboard and/or cable tray.

B. Cables shall be trained, dressed and racked on the plywood backboards. Provide cable, metal support arms and re-enterable type cable support rings not less than 12 inches on center mounted onto the plywood along the entire length of all cables.

C. Provide 18 inches of cable slack at workstation and telephone outlets.

D. Provide cables installed from individual computer/data workstation outlets to respective terminal closet/room equipment rack patch panel. Cables shall be continuous without cutting or splices.

E. Minimum bending radius of fiber optic cables shall not be less than 9-inches. Maximum pulling tension shall not exceed 600 pounds. In no case shall the manufacturer's recommendations be violated.

F. The minimum bending radius for copper wire cables shall be 10 times the cable outside diameter. The maximum pulling tension and minimum bending radius shall not violate manufacturer's recommendations.

G. Cable lengths over 50 feet shall be machine pulled not hand pulled. Cables shall be pulled in a continuous, smooth operation without jerking or stop-start motion after initiation of pull. Maximum cable pulling speed shall be less than 50 feet per minute. Minimum cable pulling speed shall be greater than 15 feet per minute.

H. The portions of cables installed without raceways or cable tray supports shall be installed with Category 6 rated “j-hooks” cable supports.

1. The “j-hooks” shall provide multitiered “treed” “j” shared hooks, with wide flat cable support base (0.5”W minimum) and smooth rounded corners, specifically designed for Category-6 and fiber optic cable support. As manufactured by Erico Inc.

2. The individual “j-hook” attachment to the building structure shall be “beam clamp”, “hanger rod”, clevis hanger styles.

3. Install “j-hooks” not more than 36 inches on center along the entire cable length, at each cable change in direction, to insure less than 6 inches of cable sag between adjacent hooks. Secure cables to “j-hooks” with cable tie wraps. “J-hooks” supported cables, bundle cables together with tie wraps.

4. “Bridle rings” shall not be used to support cables.

5. Cables shall not lay directly on ceilings, ceiling hangers, lighting fixtures, air ducts, piping, or equipment.

3.02 HANDLING OF CABLE REELS:

A. Cable ends shall be sealed prior to shipment to prevent moisture entry into cable. Cable ends shall remain sealed at all times including during installation. Where ends seals are removed, reseal cable ends by stripping cable finishes back 2" down to insulation. Then apply four layers of an insulating tape criss-cross over the cable end and carry back at least 4" onto cable outer finish. Add a containing cover of two layers of vinyl electrical tape completely over the end seal.

B. Cable reels shall be shipped with factory applied lagging (protective cover) left in place until removal is absolutely necessary. Store reels of cable on a firm surface, paved, or on planking to prevent settling into soft ground.

3.03 CABLE TERMINATIONS

A. General

1. Computer/data workstation outlets connecting to ports in patch panels shall be grouped together in the patch panel by outlet, room location and building area location. Each group shall be identified with engraved (etched) nameplates indicating grouping identification and individual port numbers.

2. Polarity and color coding of cable connections at splices, terminations and outlets shall be consistently maintained throughout the entire electronic network system.

3. Terminate all cables onto respective outlets and terminals. Terminations shall comply with manufacturer's recommendations.

B. Fiber Optic Terminations

1. Individual fiber optic fibers shall each be terminated with a fiber optic fiber connector. The connector for each fiber shall be "plugged" into separate fiber optic fiber interconnection couplers on the rear of each respective outlet.

2. Each fiber optic termination ferrule shall be inspected, after completion of the termination, visually with a fiber optic inspection microscope and an interferometer, to insure fiber “undercut”, “protruding” fiber, over polish and underpolish of fiber termination ends does not exist in the finished termination ferrule.

3. Fiber optic cables terminated between two fiber optic patch panels located in separate equipment racks. The fibers shall be paired together for purposes of identification. Each pair of fibers shall be "plugged" into separate, physically adjacent fiber optic fiber interconnection couplers at each patch panel. The horizontal/vertical arrangement of paired patch panel fiber couplers shall match at both ends of the fiber cable.

C. Copper Wire Terminations

1. Unless specifically directed otherwise by the Owner's Representative, Pin assignment for wiring terminations shall comply with ANSI/EIA/TIA 568a Type T568B.

3.04 EQUIPMENT RACKS AND CABINETS

A. General

1. Install, assemble, mount and connect devices and equipment in the respective equipment racks or cabinets, bolted securely to the rack frame with stainless steel hardware. "Star" style lock washers shall be provided to insure an electrically continuous ground path between the equipment/devices and rack frames.

2. Provide blank metal filler panels to close unused equipment "front" mounting space in equipment racks, manufacturer's standard finish color.

3. Provide a copper wire outlet connector in the respective equipment rack for each remote copper wire computer workstation outlet and copper wire cable shown connected to the respective equipment rack. The copper wire outlet connectors in the equipment racks shall be provided in equipment rack mounted copper wire patch panels.

4. Terminal racks, equipment locations, patch panels, and cross connects shall be arranged to allow for natural cabling progression, minimize crossing of cables and allow easy access to each system component.

5. Equipment Rack Anchorage:

a. Securely anchor floor standing racks to the floor at each corner.

b. Securely anchor wall-mounted racks to the wall at four corners.

c. Mounting method shall support the total rack weight including installed equipment, but in no case less than 500 pounds with a 2.0 times safety factor.

3.05 CIRCUIT TERMINAL ROOMS AND CLOSETS

A. Provide conductor/cable training and racking support distribution rings installed on backboards. Support rings shall be spaced a minimum of 10 inches on center along all cable/conductor routing paths on backboards and within 4 inches of each change in cable/conductor direction. As manufactured by Newton 3042 series, Saunders or equal.

3.06 GROUND (ADDITIONAL REQUIREMENTS)

A. Provide a ground bus at each rack bonded to the ground conductor shown on plans.

B. Provide a separate 12AWG copper stranded green insulated ground conductor from each individual equipment element in the rack to the respective rack ground bus.

3.07 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. Fiber optic and copper wire cables shall be identified in each pull box, equipment rack and computer workstation outlet. Identification tags shall include the following information:

1. Installation month and date (i.e., 3/92, 4/78 etc.).

2. Conductor size conductor type (i.e., loose tube fiber; (#24 AWG UTP Category 6, 200 pair, telephone/voice etc.).

3. Provide polypropylene tag holders with interchangeable, yellow polypropylene tag with black alpha/numeric characters sets. Characters shall be approximately .25" high.

B. Equipment and outlet naming identification and color coding shall comply with ANSI/EIA/TIA latest revision.

C. The labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

D. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, approximately sized to the OD of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly.

E. Record Drawings

1. The installation contractor will be provided with two sets of drawings at the start of the project. One set will be designated for the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the building drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by the Owner. Contractor shall also redraw, with AutoCAD version 13 or newer, the site and floor plans showing all fiber, copper, racks, and information outlets as well as the labeling scheme for all items. These CAD drawings shall be on 81/2" x 11" sheets of paper and disk, and be turned over to the owner with the O&M manuals.

2. The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

3.08 CABLE SYSTEM TESTING

A. All cables and termination hardware shall be 100% tested for defects in installation to verify cable performance under installed conditions. All conductors of each installed cable shall be verified useable by the contractor prior to system acceptance. Any defect in the cable system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

B. Each copper cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. All category 6 cables shall be tested to ensure the category 6 standard performance to 100Mhtz is complied with. All tests shall be printed out in hard copy in the quantity called out in the general specifications for O&M turn over documents as well as one disc copy for the owners use. Data cables shall be tested using a (Class II) cable analyzer.

C. Continuity

1. Each pair of each installed cable shall be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicted by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.

D. Length

1. Each installed cable shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

2. Near End Cross-Talk (NEXT)

3. Attenuation

4. Ambient Noise

5. Attenuation to Cross-Talk Ratio (ACR)

6. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected test result and the actual test result achieved.

E. Fiber

1. All fiber terminations shall be visually inspected with a minimum 200 X microscope to ensure that no surface imperfections exist after final polishing. In addition, each fiber strand shall be tested for attenuation with an optical power meter and light source as well as an OTDR. Cable length and splice attenuation shall be verified using and OTDR.

F. Attenuation

1. Horizontal distribution multimode optical fiber attenuation shall be measured at either 850 manometers (nm) or 1300 nm using and LED light source and power meter.

Backbone multimode fiber shall be tested at both 850 nm and 1300 nm in one direction. Test set-up and performance shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, Method B. One 2-meter patch cord shall be used for the test reference and two 2-meter patch cords shall be used for the actual test. This test method uses a one jumper reference, two jumper test to estimate the actual link loss of the installed cables plus the loss of two connectors. This measurement is consistent with the loss which network equipment will see under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing.

2. Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.

3. Singlemode optical fiber attenuation shall be measured at 1310 nm and 1500 nm using a laser light source and power meter. Tests shall be performed at both wavelengths in one direction on each strand of fiber. The set-up and test shall be performed in accordance with EIA/TIA-526-7 Standard, Method 1A. Two meter patch cords shall be used as test references and for the actual test. This test method utilizes a one jumper reference, two jumper test to estimate the actual link loss of the install cable plus two patch cords.

4. Test evaluation for the panel to panel (backbone) shall be based on the values set forth in the EIA/TIA-568-A Annex H, Optical Fiber Link Performance Testing.

H. Length and Splice Loss

1. Each cable shall be tested with an Optical Time Domain Refrectometer (OTDR) to verify installed cable length and splice losses. The OTDR measurements for length shall be performed in accordance with EIA/TIA-455-60. The measurements to determine splice loss shall be performed in accordance with manufactures recommendations and best industry practices. These tests shall be employed on all cables after installation and in addition where one or more of the following conditions exist.

2. OTDR and power meter testing is specifically requested by the Owner.

3. Each strand shall be tested on all outsite plant and tight-buffered cables and/or where splices exist.

4. A representative strand of each fiber cable shall be tested to verify length if the estimated cable length is within 10% of the maximum length specified, respective to cable function, in the TIA/EIA-568-A Standard.

I. Test Documentation

1. Test documentation shall be provided in a three-ring binder(s) within three weeks after the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words “Test Results”, the project name, and the date of

completion (month and year). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results (Category 3, 4, or 5), fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

2. Scanner tests shall be printed on 8-1/2" x 11". Hand written test results (attenuation results and green light results) shall be documented on and Excel spreadsheet. OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder.

3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall collocated in the binder.

3.09 FIRESTOP SYSTEMS

A. A firestop system is comprised of the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

B. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. shall be properly firestopped.

C. Firestop systems shall be UL Classified to ASTM E814 (UL 1479) and shall be approved by a qualified Professional Engineer (PE, licensed (actual or reciprocal) in the state where the work is to be performed. A drawing showing the proposed firestopped system, stamped/embossed by the cognizant PE shall be provided to the Owner's Technical Representative prior to installing the firestop system.

D. All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.

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SECTION 27 11 00

COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.

2. Backboards.

3. Telecommunications equipment racks and cabinets.

4. Telecommunications service entrance pathways.

5. Grounding.

1.3 DEFINITIONS

A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

B. BICSI: Building Industry Consulting Service International.

C. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches in width.

D. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse member rungs.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. Solid-Bottom or Nonventilated Cable Tray: A fabricated structure consisting of a bottom without ventilation openings within integral or separate longitudinal side rails.

H. Trough or Ventilated Cable Tray: A fabricated structure consisting of integral or separate longitudinal rails and a bottom having openings sufficient for the passage of air and using 75 percent or less of the plan area of the surface to support cables.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.

3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.

D. Seismic Qualification Certificates: For floor-mounted cabinets, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions. Base certification on the maximum number of components capable of being mounted in each rack type. Identify components on which certification is based.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of Commercial Installer.

2. Installation Supervision: Installation shall be under the direct supervision of [Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

3. Field Inspector: Currently registered by BICSI as Commercial Installer, to perform the on-site inspection.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.8 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

2. Record agreements reached in meetings and distribute them to other participants.

3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.

2. Support brackets with cable tie slots for fastening cable ties to brackets.

3. Lacing bars, spools, J-hooks, and D-rings.

4. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements:

a. Cable Management Solutions, Inc.

b. Cablofil Inc.

c. Cooper B-Line, Inc.

d. Cope - Tyco/Allied Tube & Conduit.

e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion.

a. Basket Cable Trays: 6 inches wide and 2 inches deep. Wire mesh spacing shall not exceed 2 by 4 inches.

b. Trough Cable Trays: Nominally 6 inches wide.

c. Ladder Cable Trays: Nominally 18 inches wide, and a rung spacing of 12 inches.

d. Channel Cable Trays: One-piece construction, nominally 4 inches wide. Slot spacing shall not exceed 4-1/2 inches o.c.

e. Solid-Bottom Cable Trays: One-piece construction, nominally 12 inches wide. Provide with solid covers.

D. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

2.2 BACKBOARDS

A. Backboards: Plywood, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels specified in Division 06 Section "Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements:

1. ADC.

2. Aim Electronics; a brand of Emerson Electric Co.

3. AMP; a Tyco International Ltd. company.

4. Cooper B-Line, Inc.

5. Hubbell Premise Wiring.

6. KRONE Incorporated.

7. Leviton Voice & Data Division.

8. Middle Atlantic Products, Inc.

9. Nordex/CDT; a subsidiary of Cable Design Technologies.

10. Ortronics, Inc.

11. Panduit Corp.

12. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.

3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.

2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.

2. Hinged and lockable front and rear doors.

3. Adjustable feet for leveling.

4. Screened ventilation openings in the roof and rear door.

5. Cable access provisions in the roof and base.

6. Grounding bus bar.

7. Rack-mounted, 550-cfm fan with filter.

8. Power strip.

9. Baked-polyester powder coat finish.

10. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.

2. Steel construction.

3. Treated to resist corrosion.

4. Lockable front doors.

5. Louvered side panels.

6. Cable access provisions top and bottom.

7. Grounding lug.

8. Rack-mounted, 250-cfm fan.

9. Power strip.

10. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.

2. Baked-polyester powder coat finish.

3. Vertical cable management panels shall have front and rear channels, with covers.

4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 GROUNDING

A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart. Width is indicated on plans.

3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.5 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

C. Install underground entrance pathway complying with Division 26 Section "Raceway and Boxes for Electrical Systems."

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.

C. Labels shall be preprinted or computer-printed type.

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SECTION 27 51 13

INTEGRATED COMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, conduit (with pull strings), wiring, telephones, annunciators, speakers, and microphones as shown on the plans, and all other equipment necessary to provide a complete and operating system.

B. The Communication system shall provide distribution of intercom, paging, emergency paging, class change time tones, emergency tone and program material. The system shall also interface with the wireless GPS clock system as specified here within. It shall also have the capability to operate a system of cameras so that visual and audible communication may be synchronized.

C. All new equipment shall be compatible with the existing systems installed on the school campus.

1.3 SUBMITTALS

A. Data sheets shall be provided on all equipment being provided.

B. Internal control cabinet drawings showing internal block diagram connections shall be provided.

C. Wiring diagrams showing typical field wiring connections shall be provided.

D. FCC registration number shall be provided.

1.4 QUALIFICATIONS

A. The Contractor shall be from an established and locally run business which has been operating in the area for a minimum of five years.

B. The Contractor shall show evidence that he maintains a service organization and parts inventory to adequately support the supplied equipment.

1.5 MAINTENANCE SERVICE

A. The Contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or engineer.

B. A maintenance contract offering continued factory authorized service of this system shall be made available if requested by the Owner.

1.6 QUALITY ASSURANCE

A. The Contractor shall currently maintain a locally run business for a minimum of five years and shall be an authorized distributor of the supplied equipment with full warranty privileges.

B. The Contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the equipment manufacturer to maintain and service the equipment being supplied. This facility shall be available for inspection by the engineer.

C. The supplying Contractor shall have attended the manufacturer's installation and service school.

D. The Contractor shall furnish manufacturer's manuals of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper operation of the system must be included. Any bidder using other than the specified equipment must provide this information prior to bidding.

E. As built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

1.7 IN SERVICE TRAINING

A. The Contractor shall furnish a minimum of four hours of in service training with the system. These sessions shall be broken into segments that will facilitate the training of individuals in operating station equipment, administrative devices, user programming functions, and program distribution equipment. Operating manuals and users guides shall be provided at the time of the training.

1.8 WIRING

A. System wiring shall be in accordance with good engineering practices as established by the EIA and NEC. Wiring shall meet all established state and local electrical codes. All wiring shall test free from grounds and shorts.

PART 2 – PRODUCTS

2.1 PUBLIC ADDRESS SYSTEM:

A. Connect new PA speakers to the existing school campus system.

B. Allow to commission the system such that the new building operates in sequence with the existing buildings.

C. Allow for any and all upgrades of existing power supplies and distribution equipment to support the new devices. Include for sub-panels and wiring blocks for the new building.

2.2 MASTER CLOCK

A. Connect new clocks to the existing school campus system.

B. Allow to commission the system such that the new building operates in sequence with the existing buildings.

C. Allow for any and all upgrades of existing power supplies and distribution equipment to support the new devices. Include for sub-panels and wiring blocks for the new building.

PART 3 – EXECUTION

3.1 CABLING

A. All cable shall be listed for the intended purpose. Use CAT, 24AWG, U.L. Listed cable. Home run all station wiring in individually jacketed cables. Number of pairs within the cable may vary due to specific field conditions.

B. All interior staff station wiring shall be in accordance with current new construction wiring guidelines published by the manufacturer, including staff speaker and call switch.

C. All interior Administrative phone(s) shall be wired in accordance with current new construction wiring guidelines published by the manufacturer.

D. All operator displays shall be connected to the system in accordance with current new construction wiring guidelines published by the manufacturer.

E. All amplified speaker circuits shall be connected using two (2) twisted pairs. One pair for line level audio and one pair for 24 VDC power. Refer to drawings for proper wire gauge. If unspecified, use CAT, 24AWG, U.L. Listed cable.

F. All constant voltage speaker circuits shall be connected using a separate twisted shielded pair. Refer to drawings for proper wire gauge.

G. Transient suppression is required on all wiring leaving the building.

H. All cables run in underground conduits must be suited for wet locations.

3.2 INSTALLATION

A. Complete system shall be installed in strict accordance with manufacturer's recommendations.

B. All wiring shall be installed in raceways where routed through plenum ceiling areas.

C. Interior station wiring shall be Southwest Wire and Cable, Inc. #171125 or equivalent.

D. Site examination:

1. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

2. Verify that 120-volt electrical outlet is located within 6 feet of the transmitter location and the outlet is operational and properly grounded.

3. Verify that all 120-volt electrical outlets for the powered clocks and bell controllers is located at the exact installation point and the outlet is operational and properly grounded

E. Cleaning: Prior to final acceptance, clean exposed surfaces of all system components, using cleaning methods recommended by the manufacturer. Remove temporary protective film and labels from clock faces.

F. Delivery: Provide training to Owner's representative on system setting and operation as demonstrated in the manufacturer system user guide.

3.3 INSPECTION AND TEST UPON COMPLETION

A. Check-out and final connections to the system shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

B. System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.

C. All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and test.

D. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.

E Upon completion of the installation of the equipment, the electrical contractor shall provide to the engineer a signed statement form the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.

F. Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The engineer will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

END OF SECTION

SECTION 28 00 10

GENERAL ELECTRONIC SAFETY AND SECURITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section and to all following sections within Division 28.

1.2 DESCRIPTION OF WORK

A. This Division requires providing complete functioning systems, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.

B. Division 28 of these Specifications, and Drawings numbered with prefixes TY AND FA, generally describe these systems, but the scope of the Electronic Safety & Security Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical and Telecommunications Drawings and Specifications; and Addenda.

C. Drawings are graphic representations of the Work upon which the Contract is based. They show the materials and their relationship to one another, including sizes, shapes, locations, and connections. They also convey the scope of Work, indicating the intended general arrangement of the equipment, fixtures, outlets and cabling without showing all of the exact details as to elevations, offsets, and other installation requirements. Use the Drawings as a guide when laying out the Work and to verify that materials and equipment will fit into the designated spaces, and which, when installed per manufacturers' requirements, will ensure a complete, coordinated, satisfactory and properly operating system.

D. Specifications, along with the device schedules located on drawing legend sheets, define the qualitative requirements for products, materials, and workmanship upon which the Contract is based.

1.3 ABBREVIATIONS

ADA	Americans with Disabilities Act
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
ETL	Electrical Testing Laboratories, Inc.
FCC	Federal Communications Commission
FM	Factory Mutual
IEEE	Institute of Electrical and Electronic Engineers
LED	Light Emitting Diode
NEC	National Electric Code
NESC	National Electrical Safety Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NICET	National Institute for Certification in Engineering Technologies
NRTL	Nationally Recognized Testing Laboratory
OEM	Original Equipment Manufacturer
OFCI	Owner Furnished Contractor Installed

OSHA	Occupational Safety and Health Administration
UL	Underwriters Laboratories
UON	Unless Otherwise Noted

1.4 QUALITY ASSURANCE

A. Execute all Work under this Division in a thorough and professional manner by competent and experienced workpersons duly trained to perform the Work specified.

B. Qualifications – refer to individual Division 28 sections for specific Personnel and Contractor Qualifications.

C. Install all Work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation.

D. Unless indicated otherwise on the Drawings, provide all material and equipment new, of the best quality and design, free from defects and imperfections and with markings or a nameplate identifying the manufacturer and providing sufficient reference to establish quality, size and capacity. Provide all material and equipment of the same type from the same manufacturer.

E. Unless specified otherwise, manufactured items of the same types specified within this Division shall have been installed and used, without modification, renovation, or repair for not less than one year prior to date of bidding for this Project.

F. Comply with the current applicable codes, ordinances, and regulations of the authority or authorities having jurisdiction, the rules, regulations and requirements of the service providers serving the project and the Owner’s insurance underwriter.

G. Drawings, specifications, codes and standards are minimum requirements. Where requirements differ, the most stringent apply.

H. Should any change in drawings or specifications be required to comply with governing regulations, notify and receive written approval from the Architect prior to submitting bid.

I. All equipment and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, NEC, NEMA, NFPA, OSHA, UL, and the State Fire Marshall.

J. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workmanlike manner by competent workmen. Provide a competent, experienced, full-time Project Manager who is authorized to make decisions on behalf of the Contractor.

K. Warranty Requirements

1. Refer to Division 1 and General Conditions for Warranties.
2. Warrant each system and each element thereof against all defects due to faulty workmanship, design or material for a minimum period of 12 months from date of Substantial Completion, or longer where specific items are required to carry a longer warranty in these Construction Documents or a manufacturer’s standard warranty exceeds the minimum. Remedy all defects, occurring within the warranty period(s), as stated in the General Conditions and Division 1.
3. Refer to individual Division 28 sections for additional warranty requirements, as certain components and systems will have warranty requirements that exceed 12 months.
4. The above warranties shall include labor and material. Make repairs or replacements without any additional costs to the Owner.

5. Schedule repairs with the Owner for times of the day, days of the week as specified by the Owner. No premiums shall be charged to the Owner for work requiring weekend or after “normal business hours” access.

6. Perform the remedial work within 48 hours, upon written notice from the Architect or Owner, unless deferred by the Owner.

7. At the time of Substantial Completion, deliver to the Owner all warranties, in writing and properly executed, including term limits for warranties extending beyond the one year period, each warranty instrument being addressed to the Owner and stating the commencement date and term.

1.5 CODES, REFERENCES, AND STANDARDS

A. Execute all Work in accordance with, and comply at a minimum with, National Fire Protection Association (NFPA) codes, state and local building codes, and all other applicable codes and ordinances in force, governing the particular class of Work involved, for performance, workmanship, equipment, and materials. Additionally, comply with rules and regulations of public utilities and municipal departments affected by connection of services. Where conflicts between various codes, ordinances, rules, and regulations exist, comply with the most stringent. Wherever requirements of these Specifications, Drawings, or both, exceed those of the above items, the requirements of these Specifications, Drawings, or both, shall govern. Code compliance, at a minimum, is mandatory. Construe nothing in these Construction Documents as permitting work not in compliance, at a minimum, with these codes.

B. Bring all perceived conflicts between codes, ordinances, rules, regulations and these documents to the Architect’s and Design Consultant’s attention in sufficient time, prior to the opening of Bids, to prepare the Supplementary Drawings and Specifications Addenda required to resolve the conflict.

1. If a conflict is not reported timely, prior to the opening of bids, resolve the conflict and provide the installation in accordance with the governing codes and to the satisfaction of the Architect and Design Consultant, without additional compensation. Contractor will be held responsible for any violation of the law.

C. Obtain timely inspections by the constituted authorities having jurisdiction; and, upon final completion of the Work, obtain and deliver to the Owner executed final certificates of acceptance from these authorities having jurisdiction.

D. All material, manufacturing methods, handling, dimensions, methods of installation and test procedures shall conform to industry standards, acts, and codes. Refer to individual sections for exact codes, references, and standards.

1.6 DEFINITIONS:

A. Whenever used in these Specifications or Drawings, the following terms shall have the indicated meanings:

1. AHJ - The local code and/or inspection agency (Authority) Having Jurisdiction over the Work.

2. Approved - Labeled, listed, or both, by an NRTL, and acceptable to the AHJ over this project.

3. As Directed - As directed by the Architect, or his representative.

4. Concealed - Embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed within hung ceilings.

5. Conditionally Approved – The manufacturer has been found reputable by the design professional, but the design professional has not verified that the product offering by manufacturer meets to all specification requirements. Contractor shall adhere to submittal review process for final approval on products.

6. Design Consultant - Where referenced in this Division, “Design Consultant” is the Design Professional for the Work under this Division, and is a Consultant to, and an authorized representative of, the Architect, as defined in the General and/or Supplementary Conditions.

7. Furnish - “To supply and deliver to the project site, ready for unloading, unpacking, assembling, installing, and similar operations.”

8. Furnished by Owner (or Owner-Furnished) or Furnished by Others: “An item furnished by the Owner or under other Divisions or Contracts, and installed under the requirements of this Division, complete, and ready for the intended use, including all items and services incidental to the Work necessary for proper installation and operation. Include the installation under the warranty required by this Division.”

9. Install - “To perform all operations at the project site, including, but not limited to, and as required: unloading, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, testing, commissioning, starting up and similar operations, complete, and ready for the intended use.”

10. NRTL - Nationally Recognized Testing Laboratory, as defined and listed by OSHA in 29 CFR 1910.7 (e.g., UL, ETL, CSA, etc.), and acceptable to the Authority having Jurisdiction (AHJ) over this project. Nationally Recognized Testing Laboratories and standards listed are used only to represent the characteristics required and are not intended to restrict the use of other NRTL’s that are acceptable to the AHJ, and standards that meet the specified criteria.

11. Provide - “To furnish and install complete, and ready for the intended use.”

12. Prime Contractor – a project’s overall contractor responsible for all Divisions of Work, usually identified as a General Contractor or Construction Manager At Risk.

13. Submit - Submit to Architect for review.

14. Substitution: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor. Substitutions include Value Engineering proposals.

    a. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.

    b. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

15. Value Engineering: A systematic method to improve the “value” of goods and services by using an examination of function. Value, as defined, is the ratio of function to cost. Value can therefore be increased by either improving the function or reducing the cost. The goal of VE is to achieve the desired function at the lowest overall cost consistent with required performance.

16. Wet Location - A location subject to saturation with water or other liquids. Pathways installed in wet locations do not protect cables from moisture such that cables installed in pathways within wet locations must be identified by their manufacturer for use in wet locations.

    a. For example: Slab-on-grade construction where pathways are installed underground or in or under concrete slabs that are in direct or indirect contact with soil (e.g., sand and gravel with or without a moisture barrier) is considered a “wet location.”

17. (*) – Where appearing in product part or model numbers; shall represent wild card character to be filled in by the contractor to meet required specifications.

B. The terms "approved equal", “equivalent”, or "equal" are used synonymously and shall mean “accepted by, or acceptable to, the Design Consultant as equivalent to the item or manufacturer specified”.

C. The following definitions apply to excavation operations:

1. Sub-base: as used in this Section refers to the compacted soil layer used in pavement systems between the sub-grade and the pavement base course material.

2. Sub-grade: as used in this Section refers to the compacted soil immediately below the slab or pavement system.

3. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction from the Architect.

1.7 COORDINATION

A. Coordinate with other Divisions for Electronic Safety and Security work to be included but not listed in Division 28 or indicated on the Security or Fire Alarm Drawings.

B. Visit the site and ascertain the conditions to be encountered in installing the Work under this Division, verify all dimensions and locations before purchasing equipment or commencing work, and make due provisions for same in the bid. Failure to comply with this requirement shall not be considered justification for omission, alteration, and incorrect or faulty installation of any of the Work under this Division or for additional compensation for any Work covered by this Division.

C. Refer to Drawings and Divisions of the other trades and to relevant equipment drawings and shop drawings to determine the extent of clear spaces. Follow these drawings as closely as the actual construction and the work of other trades will permit.

D. Maintain a project manager, as specified by the Quality Assurance sections of these specifications, on the jobsite at all times to coordinate this Work with other trades so that various components of the Division 28 systems are installed at the proper time, fits the available space, allows proper service access to all equipment, and meets all required codes and standards.

E. Execute the Work in such a manner that the Work of the other trades will not be handicapped, hindered, or delayed at any time.

F. Work of this Division shall progress according to the "Construction Schedule" as described in Division 1 and as approved by the Architect. Cooperate in establishing these schedules and perform the Work under this Division, in a timely manner in conformance with the construction schedule so as to ensure successful achievement of all schedule dates.

G. Carefully check space requirements with other trades to insure that equipment can be installed in the spaces allotted.

H. Refer to Coordination requirements in specific sections for additional information.

I. Examine and compare the Contract Drawings and Specifications with the Drawings and specifications of other trades, and report any discrepancies between them to the Architect and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.

J. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Architect for review. At completion include a set of these drawings with each set of Record Drawings.

K. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections shall be made or which shall be changed or altered.

L. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Architect.

1.8 MEASUREMENTS AND LAYOUTS

A. The Drawings are schematic in nature, but show the various components of the systems approximately to scale and attempt to indicate how they are to be integrated with other parts of the Work. Figured dimensions take precedence to scaled dimensions. Determine exact locations by job measurements, by checking the requirements of other trades, and by reviewing all Contract Documents. Correct, at no additional costs to the Owner, errors that could have been avoided by proper checking and inspection.

1.9 SUBMITTALS

A. Refer to Division 1 and General Conditions for general submittal requirements in addition to requirements specified in this section. Refer to individual Division 28 Sections for additional submittal requirements. Unless otherwise noted, it is acceptable to submit electronic, PDF files.

B. Submittals and shop drawings shall not contain the firm name, logo, seal, or signature of the Engineer. They shall not be copies of the work product of the Engineer. If the Contractor desires to use elements of such product, the license agreement for transfer of information obtained from the Engineer must be used.

C. Separate submittals according to individual specification sections. Only resubmit those sections requested for resubmittal.

D. Unless noted otherwise within each individual section, submittals shall be provided for approval in four distinct submittal stages:

1. “Pre-bid” Submittal
    a. Generally means submittals required no less than two weeks prior to the due date for the submission of bids, such as:
        1) Product substitutions, approved alternate or equivalent requests to be reviewed for approval (Prior to Bid). Coordinate with Division 1.
        2) Alternate personnel credentials to be reviewed for approval
2. ”Bid” Submittal
    a. Generally means submittals required at the time of the submission of bids, such as:
        1) Unit Pricing (if required by sections in this Division)
        2) Personnel Qualifications
        3) Contractor Qualifications
        4) Voluntary Bid Alternates
3. ”Pre-Construction” Submittal
    a. Generally means submittals required after the award of the project to the winning bidder and prior to starting construction. At a minimum, Pre-Construction submittals shall include:
        1) The project name
        2) The submitted contractor’s company name, the individual’s name responsible for the submittal, and contact information for that individual
        3) The Prime Contractor’s stamp, which shall certify that the stamped submittals have been check by the Prime Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.
    b. Submittals for this division shall be divided and titled in the following manner:
        1) Division 28 Electronic Security Systems
        2) Division 28 Fire Alarm Systems

c. Submit the following items within 4 weeks after the notice to proceed:

1) Division of Labor amongst sub-contractors. Include:

a) Information on each sub-contractor:

i) Company Name

ii) Address

iii) Name of project manager for this project, including:

(1) E-mail

(2) Telephone number

b) A detailed description or matrix identifying who is responsible for furnishing, installing, and verifying the following system components:

i) General requirements:

(1) Various system power, backup power, and grounding/bonding items.

(2) Various conduit and other common work items.

(3) Various low-voltage wires/cabling and terminations.

(4) Various structural and seismic items (including design)

ii) Individual Division 28 sections

2) Updated Personnel and Contractor Qualifications (resubmit if there are no changes)

3) Schedule - A Gantt chart or Milestone list that includes the following timetables:

a) Pre-Construction Submittals

i) Include time for resubmittals

ii) Unless otherwise stated elsewhere within these specifications, assume 1 week review time for the Prime Contractor and 2 weeks for the Architect/Division 28 Design Consultant for each submittal.

b) Material purchase/shipping schedules (to identify any long lead times for critical components)

c) Conduit Installation

d) Cabling Installation

e) Cabling termination and testing

f) Power and backup power availability

g) Equipment installation and testing

h) System startup and configuration

i) As-built drawings

j) Operation and Maintenance Manual submission, resubmission, and approval

k) Final Site Observation for Substantial Completion approval to be at least [2] weeks prior to overall project Substantial Completion date

l) Owner Training sessions

m) Other items as required by individual sections in this Division

4) Equipment List - A typed list, indexed by Specification section, of products specifically identified by part number (no wild card characters) within each specification section in

this Division. Products are to be listed in the same order as in the specification. List is to include length of manufacturer warranty for each product.

5) Data Sheets - Manufacturers' data-sheets:

a) At a minimum all product data-sheets shall contain the following:

i) The manufacturers' name and logo somewhere on the page

ii) All parts, pieces, and equipment submitted for review shall be identified specifically by stamp, or highlighted in such a manner that the product(s) being considered are clearly identifiable and distinguished from all other materials, parts or equipment that may be on the submittal.

iii) For data-sheets with accessories, additional parts, or derivations of the product being submitted all shall be clearly identified for the reviewer and acceptance.

iv) Sufficient detail for reviewer to identify all required information, such as size, weight, color, NRTL listings, approval or certification information, and other necessary identifying information to confirm product meets specifications.

b) Data-sheets are to be in the same sequential order as is presented within the specifications.

6) Warranty Information – For warranties required by this specification and other Related Sections, submit warranty terms and conditions for each system or product. These shall contain the following:

a) Length of warranty period

b) What is covered

c) All disclaimers, limitations, etc.

d) What, if anything, is not covered

7) Samples – refer to individual sections for exact sample requirements.

a) Samples requested shall be physical examples that represent materials, equipment or workmanship and establish standards by which the work will be judged. Contractor or Manufacturer is to cover return shipping if sample is to be returned.

8) Shop Drawings – Refer to individual sections for exact Shop Drawing requirements.

d. And as required by individual sections in this Division

4. "Project Completion" Submittal

a. Generally means, unless otherwise noted, submittals required to be submitted 4 weeks prior to Substantial Completion, for the Design Consultant to reference during the "Final Punch" Site Observation. Project Completion, aka "Close-out Documents" include the following:

1) Record Drawings

2) Operation and Maintenance Manuals – refer to "Operations and Maintenance Data" section below.

3) Owner training syllabus

4) Recorded Owner Training

5) Project test reports

6) Cable Databases (as applicable)

7) Warranty Certificate(s)

8) And as required by individual sections within this Division

E. For electronic submittals, Contractor shall submit the documents in accordance with the procedures specified in Division 1. Contractor shall notify the Architect and Design Consultant that the shop drawings have been posted. If electronic submittal procedures are not defined in Division 1, Contractor shall include the website, user name and password information needed to access the submittals. For submittals sent by e-mail, Contractor shall copy the Architect and Design Consultant's designated representatives. Contractor shall allow the Design Consultant review time as specified above in the construction schedule. Contractor shall submit only the documents required to purchase the materials and/or equipment in the electronic submittal and shall clearly indicate the materials, performance criteria and accessories being proposed. General product catalog data not specifically noted to be part of the specified product will be rejected and returned without review.

F. Identify each sheet of printed submittal pages (using arrows, highlighting, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out or line-through non-applicable information. Note specified features such as materials or paint finish.

G. Provide submittals in sufficient detail so as to demonstrate compliance with these Contract Documents and the design concept.

H. Transmit submittals as early as required to support the project schedule. Allow two weeks Design Consultant review time, plus a duplication of this time for resubmittals, if required. Transmit submittals as soon as possible after Notice to Proceed and before construction starts.

I. No part of the work shall be started in the shop or in the field until the shop drawings and /or samples for that portion of the work have been submitted and accepted.

J. Before transmitting submittals and material lists, verify that the equipment submitted is compatible with and suitable for the intended use. Verify that the equipment will fit the available space and allow ample room for maintenance. If the size of equipment furnished makes necessary any change in location, or configuration, submit a shop drawing showing the proposed layout.

K. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the shop drawings, product data and samples, the Contract Documents govern the work and are neither waived nor superseded in any way by the review of shop drawings, product data and samples.

L. Submittals shall contain the following information. Submittals not so identified will be returned to the Contractor without action:

1. The project name
2. The applicable Specification Section
3. The submittal date
4. The submitting contractor's company name and the project manager's name and contact information.

M. The Contractor's stamp, which shall certify that the stamped drawings have been checked by the Contractor, comply with the Drawings and Specifications, and have been coordinated with other trades.

N. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, piping and service connection data.

O. The Design Consultant's checking and subsequent acceptance of such submittals shall not relieve the Contractor from responsibility for deviations from Drawings or Specifications unless he has, in writing, called the Design Consultant's and Architect's attention to such deviations at the time of submission, and secured written acceptance; nor shall it relieve the Contractor from responsibility for errors in dimensions, details, sizes of members, or quantities; or for omissions of components or fittings; or for not coordinating items with actual building conditions and adjacent work.

P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of architectural conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.

Q. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor for resubmittal.

1.10 ELECTRONIC DRAWING FILES

A. AutoCAD

1. In preparation of shop drawings or record drawings, Contractor may, at their option, obtain electronic drawing files in AutoCAD or DXF format from the Engineer for a shipping and handling fee of $200 for a drawing set up to 12 sheets and $15 per sheet for each additional sheet. Contact the Architect for Architect's written authorization. Contractor shall request and complete the Electronic File Release Agreement form from the Engineer. Send the form along with a check made payable to Henderson Engineers, Inc. Contractor shall indicate the desired shipping method and drawing format on the attached form. In addition to payment, Architect's written authorization and Engineer's release agreement form must be received before electronic drawing files will be sent.

1.11 SUBSTITUTIONS

A. Refer to Bid documents, General and Supplementary Conditions and Division 01 Specification Sections for limitations and restrictions on substitutions in addition to requirements specified in this section.

B. For products, materials, equipment, or systems for which this Division specifically identifies, the Contractor shall use it as the basis for their bid. However, if the Contractor feels a substitute is appropriate for consideration they may submit, as required in these documents prior to bid, for approval by the Design Consultant.

C. Materials, products and equipment described in the Bidding Documents establish a standard of required function, performance, dimension, appearance and quality to be met by the proposed substitution.

D. The base bid shall include only the products from manufacturers specifically named in the drawings and specifications.

E. Request for Substitution:

1. Complete and send the Substitution Request Form attached at the end of this section for each material, product, equipment, or system that is proposed to be substituted.

2. The burden of proof of the merit of the proposed substitution is upon the proposer.

3. Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner the following:

a. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.

b. Proposed substitution is consistent with the Contract Documents and will produce indicated results, including functional clearances, maintenance service, and sourcing of replacement parts.

c. Proposed substitution has received necessary approvals of authorities having jurisdiction.

d. Same warranty will be furnished for proposed substitution as for specified Work.

e. If accepted substitution fails to perform as required, Contractor shall replace substitute material or system with that originally specified and bear costs incurred thereby.

f. Coordination, installation and changes in the Work as necessary for accepted substitution will be complete in all respects.

F. Substitution Consideration:

1. No substitutions will be considered unless the Substitution Request Form is completed and attached with the appropriate substitution documentation.

2. No substitutions will be considered with receipt of Bids, unless the Architect and Design Consultant have received from the Bidder a written request for approval to bid a substitution at least ten calendar days prior to the date for receipt of Bids, and have approved the substitution request.

3. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work of related trades are not permitted.

4. If the proposed substitution is approved prior to receipt of Bids, such approval will be stated in an Addendum. Bidders shall not rely upon approvals made in any other manner, including verbal. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials which meet the performance as stated or implied in the Contract Documents.

5. No substitutions will be considered after the Contract is awarded unless specifically provided in the Contract Documents.

1.12 OPERATION AND MAINTENANCE DATA

A. Refer to Division 1 and General Conditions for Operation and Maintenance Data.

B. Prior to Substantial Completion of the project, furnish to the Architect, for Design Consultant's review, and for the Owner's use, the following Division 28 items:

1. An electronic PDF file containing:

a. A parts list of all equipment installed

b. Equipment data-sheets for all equipment installed,

c. Summary of all settings and configurations for each piece of installed equipment

d. Listing of all software and versions install

e. All software licensing information

f. Record Drawings completed in electronic format, updated from submitted Shop Drawings,

g. Manufacturer's service and maintenance data,

h. Warranty certificates

i. Include local contacts complete with address and telephone number, for equipment, apparatus, and system components furnished and installed under this Division of the specifications.

C. Instruct the Owner's permanent personnel in the proper operation of, startup and shutdown procedures and maintenance of the equipment and components of the systems installed under this Division.

D. Refer to individual sections in this Division for additional requirements.

1.13 APPROVED EQUIVALENTS

A. For specific products, materials, equipment, or systems for which this Division specifically identifies the Contractor shall use as the basis for their bid. Where the term approved equivalent or equal is listed the contractor may submit documentation for review by the Design Consultant for approval. The Design Consultant’s acceptance or rejection is final.

1.14 VOLUNTARY ALTERNATE BIDS

A. Voluntary alternate bids will be accepted provided they are included in conjunction with a valid base bid or bid approved as an acceptable substitution by the Design Consultant.

1.15 RECORD DRAWINGS

A. Refer to Division 01 and General Conditions for Record Drawings in addition to requirements specified in this section.

B. Maintain on a daily basis a set of jobsite work prints of the Issued for Construction Drawings, reflecting an accurate dimensional record of deviations between work shown on Drawings and that actually installed.

1. Record dimensions clearly and accurately to delineate the work as installed; suitably identify locations of all equipment by at least two dimensions to permanent structures.

2. Pay particular attention to those items that require locating for servicing. This includes, but is not limited to, above-ceiling items such as:

a. Cable and conduit routing

b. Pullbox and junction box locations

C. At the completion of the project, obtain reproducible electronic copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done electronically in AutoCAD or Revit and saved to PDF format. Mark each sheet "Record Drawing", along with the date, and deliver these Record Drawings to the Architect.

1. PDF versions of the drawings shall have searchable text. “Flattened” PDFs will not be acceptable.

1.16 DELIVERY, STORAGE AND HANDLING

A. Refer to Division 1 and General Conditions for Delivery, Storage and Handling in addition to requirements specified herein.

B. Deliver equipment and material to the job site in their original containers with labels intact, fully identified with manufacturer's name, make, model, model number, type, size, capacity and Underwriter's Laboratories, Inc. labels and other pertinent information necessary to identify the item.

C. Deliver, receive, handle and store equipment and materials at the job site in the designated area and in such a manner as to prevent equipment and materials from damage and loss. Store equipment and materials delivered to the site on pallets and cover with waterproof, tear resistant tarp or plastic or as required to keep equipment and materials dry. Follow manufacturer's recommendations, and at all times, take every precaution to properly protect equipment and material from damage, including the erection of temporary shelters to adequately protect equipment and material stored at the Site. Equipment and/or material which becomes rusted or damaged shall be replaced or restored by the Contractor to a condition acceptable to the Architect and Design Consultant.

D. Be responsible for the safe storage of tools, material and equipment.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Use only products listed for their intended use by a NRTL, except products for which no relevant standards exist.

B. Where products are required to be NRTL listed, classified, approved or otherwise each individual item shall bear the NRTL mark by permanent means.

C. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.

D. Products and materials shall not contain asbestos, PCB, or any other material, which is considered hazardous by the Department of Environmental Protection or any other authority having jurisdiction.

E. As directed by the Architect, replace materials of less than specified quality and relocate work incorrectly installed.

F. Refer to individual sections for labeling requirements.

G. Install materials and equipment with qualified trade people.

H. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.

I. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.

J. Where factory testing of equipment is required to ascertain performance and attendance by the Owner's representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.

K. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be de-rated with the method of de-rating identified on the submittals.

L. Enclosures for Electronic Safety and Security Infrastructure/equipment installed in mechanical equipment rooms shall be NEMA type 1 gasketed. Enclosures for Electronic Safety and Security Infrastructure/equipment installed outdoors shall be NEMA type 3R.

M. If products and materials are specified or indicated on the drawings for a specific item or system, use those products or materials. If products and materials are not listed in either of the above, use first class products and materials, subject to approval of product data submittal.

N. Ship and store all products and materials in a manner that will protect them from damage, weather and entry of debris. If items are damaged, do not install, but take immediate steps to obtain a replacement. Repairs of damaged goods will only be permitted with prior written permission of the Owner/Design Consultant.

O. Part numbers and product codes in these specifications are correct as of the time of writing. Manufacturers may, however, change part numbers and product codes on short notice. In cases where part numbers or product codes differ from technical specifications for a particular product, provide products meeting the minimum technical specifications of the products in the specifications. Notify the Owner/Design Consultant of any product code and or part number changes on the material list submittal.

PART 3 - EXECUTION

3.1 FEES AND PERMITS

A. Secure and Pay all required fees and obtain all required permits related to the Electronic Safety and Security Systems' installation.

B. Pay royalties or fees in connection with the use of patented devices and systems.

3.2 EXISTING SERVICES

A. Existing Electronic Safety and Security Infrastructure services not specifically indicated to be removed or altered shall remain as they presently exist.

B. Where existing services interfere with new construction, alter or reroute such existing equipment to facilitate new construction after obtaining written permission from the Architect. Notify in writing giving two weeks advance notice or planned alteration prior to altering any existing condition is required.

C. Schedule and coordinate with the Owner and with the Architect all connections to, relocation of, or discontinuation of normal services from any existing service provider line. Include all premium time required for all such work in the Bid.

D. Preserve continuity of service of existing facilities (related to damage or alteration due to new construction). Unauthorized alteration to existing equipment shall be corrected without additional cost to the Owner.

E. Repair all existing utilities damaged due to construction operations to the satisfaction of the Owner or Utility Company without additional cost.

F. Do not leave services disconnected at the end of a workday or over a weekend unless authorized by representatives of the Owner or Architect.

G. Make repairs and restoration of services before workmen leave the project at the end of the workday in which the interruption takes place.

H. Include in Bid the cost of furnishing temporary facilities to provide all services during interruption of normal utility service.]

3.3 EXAMINATION OF SITE

A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.

B. The Contract Documents do not make representations regarding the character or extent of the sub-soils, water levels, existing structural, mechanical, electrical, communications, and Electronic Safety and Security installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.

3.4 CLEANING

A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.

B. Immediately prior to final inspection, make a final cleanup of dirt and refuse resulting from Work and assist in making the premises vacuum clean. Clean all material and equipment installed under this Division.

C. Clean all fixtures and equipment at the completion of the project. Wipe clean exposed lighting fixture reflectors and trim pieces with a non-abrasive cloth just prior to occupancy.

D. Remove dirt, dust, plaster, stains, and foreign matter from all surfaces.

E. Touch up and restore damaged finishes to their original condition.

F. All Electronic Safety and Security infrastructure and equipment shall be thoroughly vacuumed and wiped clean prior to startup and at the completion of the project. Equipment shall be opened for observation by the Architect as required.

3.5 DELIVERY, DRAYAGE AND HAULING

A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, and provide proper storage and protection until the time it is required. Pay for all costs of demurrage or storage.

B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, then Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc. at no additional cost to the Owner.

3.6 EQUIPMENT AND MATERIAL PROTECTION

A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost to the Owner.

B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment to moisture damage in dry, heated spaces.

C. Provide adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.

3.7 ADJUSTING, ALIGNING AND TESTING

A. Adjust, align and test all Electronic Safety and Security infrastructure and equipment furnished and/or installed under this Division.

B. Check and test protective devices for specified and required application, and adjust as required.

C. Verify that completed wiring system is free from short circuits, unintentional grounds, low insulation impedances, and unintentional open circuits.

D. Notify the Architect immediately of all operational failures caused by defective material, labor or both.

E. Refer to individual Sections for additional and specific requirements.

3.8 START-UP OF SYSTEMS

A. Prior to start-up of Electronic Safety and Security systems, check all components and devices, to confirm compliance with manufacturers' recommended installation procedures.

B. Demonstrate that all equipment and systems perform properly as designed per Drawings and Specifications.

C. Refer to individual Sections for additional and specific requirements.

3.9 OPERATING INSTRUCTIONS

A. Instruct Owner's operating and maintenance personnel in proper starting sequences, operation, shutdown, general maintenance and preventative maintenance procedures, including normal and emergency procedures.

B. Refer to individual Sections for additional and specific requirements.

3.10 SUBSTANTIAL COMPLETION REVIEW

A. Prior to requesting a site observation for "CERTIFICATION OF SUBSTANTIAL COMPLETION", complete the following items:

1. Submit complete Operation and Maintenance Data.
2. Submit complete Record Drawings.
3. Perform all required training of Owner's personnel.
4. Turn over all spares and extra materials to the Owner, along with a complete inventory of spares and extra materials being turned over.
5. Perform start-up tests of all systems.
6. Remove all temporary facilities from the site.
7. Comply with all requirements for Substantial Completion in the Division 1 and General Conditions.

B. Request in writing a review for Substantial Completion. Give the Architect at least seven (7) days notice prior to the review.

C. State in the written request that the Contractor has complied with the requirements for Substantial Completion.

D. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.

E. If the Contractor requests a site visit for Substantial Completion review prior to completing the above-mentioned items, then provide reimbursement to the Architect and Design Consultant for time and expenses incurred for the visit.

F. Upon completion of the review, the Architect and Design Consultant will prepare a "final list" of outstanding items to be completed or corrected for final acceptance.

G. Omissions on the "final list" shall not relieve the Contractor from the requirements of the Contract Documents.

H. Prior to requesting a final review, submit a copy of the final list of items to be completed or corrected. State in writing that each item has been completed, resolved for acceptance or the reason it has not been completed.

3.11 EARLY OCCUPANCY

A. Failure to meet the Substantial Completion date can result in the Owner needing to take early occupancy. Complete the systems which are necessary to allow partial early occupancy of the building by original Substantial Completion date.

1. Refer to individual sections for additional requirements.

B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

END OF SECTION

SUBSTITUTION REQUEST FORM

To Project Engineer: _____ Request # (GC Determined): _____

Project Name: _____

Project No/Phase: _____ Date: _____

Specification Title: _____

Section Number: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

_____

Manufacturer: _____ Model No.: _____

Address: _____ Phone: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified Work: _____

_____

☐ Point-by-point comparative data attached – REQUIRED BY ENGINEER
Comparative data may include but not be limited to performance, certifications, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements. Include all information necessary for an evaluation.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ Other: _____

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain: _____

_____

_____

Substitution Certification Statement:

Unless stated otherwise in writing to the Engineer by the Contractor, Contractor warrants to the Engineer, Architect, and Owner that the:

A. Proposed substitution has been fully investigated and determined to meet or exceed the specified Work in all respects.
B. Proposed substitution is consistent with the Contract Documents and will produce indicated results.
C. Proposed substitution does not affect dimensions and functional clearances.
D. Proposed substitution has received necessary approvals of authorities having jurisdiction.
E. Same warranty will be furnished for proposed substitution as for specified Work.
F. Same maintenance service and source of replacement parts, as applicable, is available.
G. Proposed substitution will not adversely affect other trades or delay construction schedule.
H. Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitting Contractor	Date	Company

Manufacturer's Certification of Equal Quality:

I _____ represent the manufacturer of the Proposed Substitution item and hereby certify and warrant to Architect, Engineer, and Owner that the function and quality of the Proposed Substitution meets or exceeds the Specified Item.

Manufacturer's Representative	Date	Company

Engineer Review and Recommendation Section

Recommend Acceptance	☐ Yes	☐ No
Additional Comments:	☐ Attached	☐ None

Acceptance Section:

Contractor Acceptance Signature	Date	Company
Owner Acceptance Signature	Date	Company
Architect Acceptance Signature	Date	Company
Engineer Acceptance Signature	Date	Company

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SECTION 28 05 01

COMMON WORK RESULTS FOR ELECTRONIC SECURITY

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. This Section includes general construction materials and methods, electronic security equipment coordination, and common Electronic Security Systems installation requirements as follows:

1. Pathways
    a. Conduit
    b. Outlet Boxes
    c. Pull Boxes
2. Grounding and Bonding
3. Firestopping Systems
4. Access Panels
5. Identification

B. *Note* Refer to Division 28 Section “Common Work Results for Fire Alarm Systems” for common work requirements for fire alarm systems. This section specifies the common work requirements of all other Division 28 sections.

1.2 RELATED SECTIONS

A. Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations in Division 28 Section “General Electronic Safety and Security Requirements”

B. Firestopping requirements listed in this section are unique to Division 28 Work. Refer to Division 07 Section “Penetration Firestopping” for general and additional firestopping requirements.

C. Refer to Division 26 for materials and methods for additional requirements for the following:

1. Division 26 Section “Common Work Results for Electrical” for electrical systems coordination.
2. Division 26 Section “Low-Voltage Electrical Power Conductors and Cables” for electrical systems coordination.
3. Division 26 Section “Hangers and Supports for Electrical Systems” for electrical systems coordination.
4. Division 26 Section “Raceways and Boxes for Electrical System” for electrical systems coordination.
5. Division 26 Section “Underground Ducts and Raceways for Electrical Systems” for electrical systems coordination.
6. Division 26 Section “Low-Voltage Transformers” for electrical systems coordination.

D. Refer to Division 27 for materials and methods for additional requirements for the following:

1. Division 27 Section “Common Work Results for Communications” for telecommunication systems coordination.
2. Division 27 Section “Underground Ducts and Raceways for Communications” for telecommunication systems coordination.
3. Division 27 Section “Structured Cabling System” for telecommunication systems coordination.
4. Division 27 Section “Telecommunications Equipment Room Fittings” for telecommunication systems coordination.

1.3 CODES, STANDARDS, AND GUIDELINES

A. Follow all applicable codes, references, and standards listed in Division 28 Section “General Electronic Safety and Security Requirements”.

B. Follow all guidelines listed in Division 28 Section “General Electronic Safety and Security Requirements”.

C. Follow the correct revision or printing (UON) of all applicable codes, references, standards, and guidelines.

D. Follow the additional codes, references, standards and guidelines:

1. Follow the additional codes, references, standards and guidelines:
    a. For Telecommunications Infrastructure (Category 5e/6/6A and fiber optic cabling) required by this division:
        1) ANSI/TIA/EIA-569-C – “Commercial Building Standard for Telecommunications Pathways and Spaces”
    b. For Firestopping installed by this division:
        1) ASTM E 814 and ANSI/UL1479 –“Fire Tests Through Penetration Firestops”
        2) ASTM E 84 and ANSI/UL 723 “Surface Burning Characteristics of Building Materials”
        3) ASTM E 119 and ANSI/UL 263 “Fire Tests of Building Construction Materials”

1.4 QUALITY ASSURANCE

A. Install all Work in strict conformance with all manufacturers' requirements and recommendations, unless these Documents exceed those requirements. Install all equipment and materials in a neat and professional manner, aligned, leveled, and adjusted for satisfactory operation, in accordance with NECA guidelines.

B. Firestopping Systems

1. Firestopping material and systems shall be tested and listed by UL. All firestopping products shall bear this classification marking.
2. Installation technicians shall be by qualified and trained personnel. Acceptable installer qualifications are as follows:
    a. FM Research, approved in accordance with FM AS 4991.
    b. Individuals who are trained and certified by the firestopping manufacturer. For Specified Technologies, all installers shall have current FIT Level 1 certification.

1.5 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Section “General Electronic Safety and Security Requirements”.

B. The following submittals are due as part of the Pre-Bid Submittal:

1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution, provide submittals with sufficient detail for review by the Design Consultant. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information. Be prepared to submit a sample should the Design Consultant request an evaluation.

C. The following submittals are due at the Pre-Construction Submittal:

1. Contractor Qualifications (for Firestopping Systems): Provide copies of training/certification as required in the Quality Assurance portion of this specification section.

2. Parts List: Provide a typed list indicating part name, manufacturer, part number, and color (if applicable) for products specifically identified herein by the exact and complete part number (no wild-card characters).

3. Submit manufacturers' cut sheets or catalog cut sheets of each of the pathways not specifically identified by its exact part number:

    a. Cut sheets shall include the following information at a minimum:

        1) Manufacturers name and logo

        2) Size – including physical and loading dimensions

        3) Maximum span length

        4) Weight supported

        5) Type

        6) Fittings to be used

        7) Method of attachment to structure

        8) Firestop system assembly information for each system to be installed:

            a) Documentation from UL catalog for each system proposed. This documentation shall include the following information:

                i) Firestop manufacturer

                ii) UL system number

                iii) F, T, and L Ratings

                iv) The complete description of the firestop system; To include what specific construction the system is intended to pass through such as a wall or floor assembly, the penetrating items allowed to pass through the opening in the wall or floor assembly, and the materials designed to prevent the spread of fire through the openings.

4. Shop Drawings:

    a. Submit for review scaled layout drawings showing the size/routing of all pathways and and the size/information/locations of all boxes, pullboxes, firestopping systems, and access panels.

        1) Each pathway shall be identified by type and size on the drawings.

            a) Example #1: 4" EMT

            b) Example #2: 2" IMC

        2) Each grounding conductor shall be identified by size (and insulation):

            a) Example: #3/0 insulated ground

3) Each firestop system shall be identified by Manufacturer and Product, as well as UL system number for that particular location.

a) Example #1 – Firestopping Sleeve: EZ-Path Series 22, UL System W-L-3255

b) Example #2 – Backbox in Fire-Rated Wall: Specseal Power Shield, UL System QCSN/CLIV.R14288

4) Each pullbox and access panel shall be identified by size and height above finished floor.

a) Pullbox Example: Pullbox 8” x 24” x 40” approximately 12’ AFF.

b. Include pathway systems (conduit, cable tray, auxiliary supports, etc.) and other common work on the same shop drawings for Division 28 “Electronic Security Systems”.

1) The following submittals are due at the Project Completion Submittal:

a) Record Drawings:

i) Based on the work prints kept on the jobsite and official changes to the Contract Documents (such as Change Orders, Architect’s Supplemental Instructions, and Design Change Directives), create final drawings incorporating any minor and approved changes to the submitted Shop Drawings. Submit this set in accordance with the Record Drawings requirements of Division 28 Section “General Electronic Safety and Security Requirements”.

b) Keys – Supply two copies of every key as required for pullboxes, junction boxes, and access panels.

1.6 DEFINITIONS

A. Conditionally Approved - the manufacturer has been found reputable by the Design Consultant, but the Design Consultant has not verified that the product offering by manufacturer meets to all specification and project requirements. Contractor shall adhere to submittal review process for final approval on products.

B. Conveniently Accessible – Capable of being reached from the floor or via the use of an 6 to 12 foot step ladder without crawling or climbing over or under obstacles such as piping, duct work, motors, transformers, pumps, etc.

C. Firestopping System – Firestopping products that have been specifically tested and rated by a Nationally Recognized Testing Laboratory (NRTL), such as UL, to provide the required flame (F), fire and temperature (T), air and smoke (L), and water (W) containment for a given partition/penetration.

D. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.

E. IMC – Intermediate Metal Conduit

F. Plenum – A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

G. Plenum-rated – A product that is listed by a NRTL as being suitable for installation into a plenum space.

H. RMC – Rigid Metal Conduit

I. Surface Metal Raceway – A metallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

J. Surface Nonmetallic Raceway – A nonmetallic raceway that is intended to be mounted to the surface of a structure, with associated couplings, connectors, boxes, and fittings for the installation of electrical conductors.

K. UL – Underwriters Laboratory

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.

3. To allow right of way for piping, ducts, and other systems installed at required slopes and/or elevations.

4. So connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.

5. Adjust location of conduits, terminal blocks, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.

a. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.

b. Provide offsets, transitions and changes in direction of conduit* as required to maintain proper headroom and pitch on sloping lines. *Refer to Part 3 of this section for stringent conduit bend requirements.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for Division 28 equipment that are behind finished surfaces or otherwise concealed.

D. Coordinate testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

PART 2 - PRODUCTS AND MATERIALS

2.1 PATHWAYS FOR ELECTRONIC SECURITY SYSTEMS

A. General

1. Category 6 and fiber cabling and pathways between Equipment Rooms (shared Communications Rooms) and devices are by Division 27.

2. All other cabling serving Electronic Security System devices within the footprint of the building shall meet the following requirements (from device to Equipment Room):

a. Within concealed conduit from device to overhead ceiling space.

b. For areas above accessible ceilings, supported via J-hooks every 48”-60” back to nearest cable tray or serving Equipment Room. For inaccessible ceilings or ceilings exposed to structure, continue routing cable within conduit.

3. Division 28 “Electronic Security Systems” Contractor is to indicate proposed pathway types/supports and routing on Division 281000 Shop Drawings.

B. Conduit

1. The following manufacturers are Conditionally Approved.

a. Metal Conduit and Tubing

1)	AFC Cable Systems	www.afcweb.com
2)	Anaconda/Anamet	www.anacondasealtite.com
3)	AtKore/Allied Tube & Conduit	www.atkore.com
4)	Electri-Flex Co.	www.electriflex.com
5)	Emerson/O-Z Gedney	www.emersonindustrial.com
6)	Sapa/Indalex	www.sapagroup.com
7)	Southwire/Alflex	www.southwire.com
8)	Wheatland Tube Co.	www.wheatland.com

9) Or Approved Substitution (submitted and accepted in the “pre-bid” phase)

b. Nonmetallic Raceway and Tubing

1)	AFC Cable Systems	www.afcweb.com
2)	Anaconda/Anamet	www.anacondasealtite.com
3)	AtKore/Allied Tube & Conduit	www.atkore.com
4)	Cantex Inc.	www.cantexinc.com
5)	CertainTeed	www.certainteed.com
6)	Condux	www.condux.com
7)	Duraline	www.duraline.com
8)	Electri-Flex Co.	www.electriflex.com
9)	Superflex Ltd.	www.superflex.com
10)	Thomas & Betts/Carlon	www.tnb.com

c. Or Approved Substitution (submitted and accepted in the “pre-bid” phase)]

2. Specifications

a. Refer to Electrical Division 26 for specific product and material information.

1) Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.

b. Conduits routed within the building as connection to outside devices (exterior to the footprint of the building) shall be rigid metal (RMC) or intermediate metal conduit (IMC) at the point it enters the building, emerges from an exterior wall or ground floor slab to the final Equipment Room termination/transition point.

1) If services enter a room or space such as a mechanical room, electrical room or other intermediate room due to convenience or proximity to the exterior and adequate space has not been provided within 50 feet for the equipment needed for transitioning

these and future cables/services to an appropriately rated indoor cable then those conduits shall be continued uninterrupted (except for necessary pull boxes) to the final connection point or location where the transition point has been designated.

c. For interior devices (and devices on the face of exterior walls) Electrical metallic tubing (EMT) with compression connectors shall be used where concealed in walls, above ceiling, and exposed or concealed in equipment rooms.

d. Unless specifically identified on the Security drawings, flexible conduit shall not be used.

e. Conduits shall be dedicated to specific sub-systems (i.e. video cabling shall not be installed in any other sub-system conduit, such as access control, intrusion detection, fire alarm, etc.).

f. Provide conduit as indicated on the Drawings or required by this Specification.

1) Minimum conduit size for all Category 6 cabling shall be: ¾" inch for interior locations and 1" for exterior locations (such as devices at light poles and gates).

2) Provide a polypropylene or monofilament plastic line with not less than 200-lb tensile strength in each conduit.

3) Permanently mark or tag each conduit at the source and inside each pull box, identifying it based on specific subsystem (Access Control, Intrusion Detection, etc) and far-end destination. Each conduit that is stubbed into the ceiling space from an outlet box shall be permanently marked or tagged; refer to Labeling requirements in Section 3 – Execution.

C. Outlet Boxes

1. The following manufacturers are Conditionally Approved, unless otherwise noted.

a. Emerson/Appleton

b. Hubbell/RACO

c. Randl Industries

d. Thomas & Betts/Steel City

e. Or Approved Substitution (submitted and accepted in the "pre-bid" phase)

2. Specifications

a. Boxes shall either be square or rectangular, as noted on the drawings. Dimensions indicate minimum size.

b. For masonry (CMU) walls, backbox shall be 3-1/2 inches deep. Manufacturer shall be:

1) Single gang – RACO 695R, no substitutes

2) Double gang – RACO 696R, no substitutes

c. For stud walls, backbox shall be 2-3/4 inches deep. Manufacturer shall be:

1) Single gang – RACO 560 series, or equivalent from Conditionally approved manufacturer.

d. Telecommunications Boxes for Security – for camera outlets shown on TY drawings:

1) For stud walls: dual-gang outlet box shall be a minimum size of 4-11/16 inches width by 4-11/16 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension as needed for flush mounting. Depth shall match that of wall gypsum board(s).

a) Double gang – RACO 258/259 (Coordinate knock-out size with conduit size indicated on drawings), RANDL T-55017 or equivalent with appropriate

2) For ceilings (flush or above accessible ceiling): plenum-rated, dual-gang outlet box shall be a minimum size of 4 inches width by 4 inches height by 2-1/8 inches depth, with a dual-gang or single-gang raised cover/extension ring as needed for flush mounting. Depth shall match thickness of gypsum ceiling board(s) or accessible ceiling panel (if applicable).

a) Double gang – RACO 239 or equivalent, with ceiling grid framing where installed in accessible ceiling.

e. Junction Box – in accessible ceiling space above access controlled doors

1) Minimum Size 6” x 6” x 4” deep, or as noted on drawings/details, with hinged cover

2) NEMA 1 rating

3) Manufacturer shall be Hoffman A6N64 (or larger) or equivalent from Conditionally approved manufacturer.

f. Pull Boxes - for interior use only, mounted in Conveniently Accessible Locations.

1) Specifications

a) NEMA 1

b) Refer to Execution section for sizing requirements.

2) The following manufacturers are Conditionally Approved.

a) Hoffman

b) NEMA Enclosures

c) Wiegmann

d) Or Equivalent

2.2 GROUNDING AND BONDING

A. Refer to drawings and Division 28 Section “Equipment Room Fittings for Electronic Security” for exact grounding and bonding requirements.

2.3 FIRESTOPPING SYSTEMS

A. General

1. The following manufacturers are Conditionally Approved.

a. 3M

b. Hilti

c. Specified Technologies, Inc

2. Division 28 “Electronic Security Systems” Contractor is to indicate proposed Firestopping locations that correspond to their proposed pathway and cable routing on Division 281000 Shop Drawings.

3. Refer to Architecture / Life Safety plans for locations of fire- and smoke-rated walls.

B. Fire-Rated Pathway Device – for sleeves through a single penetration (wall or floor)

1. Specifications

a. Minimum performance requirements: Shall meet testing requirements of ASTM E-814 or U.L. 1479; Shall be installed in accordance with the NRTL. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer’s instructions.

b. Shall meet or exceed the ratings of the wall or floor that it penetrates.

c. Shall be a pre-fabricated and zero-maintenance solution which requires no action to activate the fire and smoke protective characteristics of the device.

d. Allows the installation and removal of cables without the need to remove or add any materials.

e. Used to seal penetrations of cables through fire rated partitions

2. Manufacturer shall be:

a. EZ-Path family of products by Specified Technologies Inc.

b. SpeedSleeve series of products by Hilti

c. Or approved equivalent

C. Firestopping for Backboxes in Fire-Rated Walls

1. Specifications

a. Used to seal backboxes in fire rated partitions.

b. Minimum performance requirements: Shall meet UL testing requirements of UL 263 and classified as Wall Opening Protective Material (QCSN or CLIV); Shall be installed in accordance with the NRTL. Shall meet or exceed the ratings of the wall or floor that it is located in.

c. Provide fire stop systems appropriate for the specific application and in accordance with manufacturer's instructions.

2. Manufacturer shall be:

a. Specified Technologies Inc., SpecSeal Power Shield

b. Or approved equivalent

D. Firestopping for Thru-Wall (or Floor) Conduit Penetrations and Other Applications

1. For fire-rated penetrations where the pathway extends beyond a single fire-rated partition, and other required firestopping applications not previously addressed in this specification.

2. Specifications:

a. Shall be UL listed for the specific application; Shall meet or exceed the ratings of the wall or floor that it penetrates.

3. Manufacturer shall be:

a. Specified Technologies Inc.

b. Or approved equivalent

2.4 ACCESS PANELS

A. The following manufacturers are Conditionally Approved.

1. Activar/J.L Industries www.activarcpg.com
2. Acudor Products www.acudor.com
3. Alfab/Barco www.alfabinc.com
4. Elmdor Products www.elmdorproducts.com
5. Karp Associates, Inc. www.karpinc.com
6. Milcor www.commercialproductsgroup.com

7. Nystrom Building Products www.nystrom.com
8. Williams Brothers www.wbdoors.com
9. Wind-lock www.wind-lock.com
10. Or Approved Substitution (submitted and accepted in the “pre-bid” phase)

B. Specifications:

1. To be utilized for access to a Pull Box that is installed above an inaccessible ceiling (where a Pull Box is required to keep the number of bends in conduit to 180 degrees or less between pull points).
2. Steel Access Panels and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation.
3. Joints and seams: continuously welded steel, with welds ground smooth and flush with adjacent surfaces.
4. Frames: 16-gauge steel, with a 1 inch (25.4 mm) wide exposed perimeter flange for units installed in unit masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling:
   a. For installation in masonry, concrete, ceramic tile, or wood paneling: 1-inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
   b. For gypsum wallboard or plaster: perforated flanges with wallboard bead.
   c. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter of frame.
5. Flush Panel Doors: 14-gauge sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
6. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

C. Locking Devices:

1. Wherever these are located in a publically accessible space and are less than 9’ AFF, provide a lock.
2. Lock shall be 5-pin or 5-disc type cylinder locks, individually keyed.
3. Provide 2 keys.

D. Indicate proposed size and locations on pre-construction shop drawings. No access panels shall be installed without Architect and Design Consultant approval.

2.5 FASTENINGS

A. Except in equipment rooms, all exposed securing screws shall be stainless steel, center pin torx security screws. Security Fasteners: A maximum of two different sets of tools shall be required to operate security fasteners for Project. Provide stainless-steel security fasteners in stainless-steel materials.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Holo-Krome; a Danaher Corporation.
2. Safety Socket Screw Corporation.
3. Tamper-Pruf Screws, Inc.
4. Textron Inc.

2.6 IDENTIFICATION FOR COMMON WORK FOR ELECTRONIC SECURITY SYSTEMS

A. Labels

1. The following manufacturers are Conditionally Approved for generic labeling requirements for conduits, pullboxes, and equipment racks.

a.	Brady	www.bradycorp.com
b.	Brother	www.brother-usa.com
c.	Dymo	www.dymo.com
d.	HellermannTyton	www.hellermanntyton.com
e.	Panduit	www.panduit.com

f. Or Approved Substitution (submitted and accepted in the “pre-bid” phase)

2. Specifications:

a. Refer to additional requirements in Part 3 – Execution.

b. Refer to individual sections for additional identification requirements for specific work.

PART 3 - EXECUTION

3.1 PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

A. General

1. Refer to Electrical Division 26 for specific installation requirements.

a. Sizes, methods, and more stringent requirements shall be adhered to when specified in this Division.

2. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

3. All supports shall be specifically designed to support the required cable weight and volume. Field manufactured supports will not be accepted.

4. Install a pull cord in each pathway (empty or not) for installation of new wires or cables. Use polypropylene or monofilament plastic line with not less than 200 lb (90.7 kg) tensile strength. Leave at least 12 inches (304.8 mm) of slack at each end of pull cord.

5. Unless otherwise noted, pathway routing shown on the Drawings is illustrative only and meant to indicate the general configuration of the work. Install pathways so that adequate clearances and offsets between pathways and other trades are provided. Coordinate all pathways with other trades prior to installation.

6. All pathways shall include empty space for a minimum of 25% growth beyond initial installation of cabling.

7. Cables shall be rigidly supported by cable pathways as indicated on the drawings. Cables shall be physically supported at intervals not to exceed 5 feet (1.52 m).

8. Store and keep dry all products in original container in a climate controlled environment until installation is to occur

9. Install all pathways:

a. So that cables are allowed to be pulled in accordance with referenced standards and guidelines.

b. So that cables are allowed to be pulled without damage to conductors, shield, armor, or jacket.

c. So that cables are not forced or allowed to exceed minimum allowed bend radius by manufacturer or referenced standards and guidelines.

d. So that the maximum allowable pulling tension is not exceeded.

e. To meet the requirements of the structure and the requirements of all other Work on the Project

f. To clear all openings, depressions, ducts, pipes, reinforcing steel, and so on.

g. Within or passing through the concrete structure in such a manner so as not to adversely affect the integrity of the structure. Become familiar with the Architectural and the Structural Drawings and their requirements affecting the raceway installation. If necessary, consult with the Architect.

h. Parallel or perpendicular to building lines or column lines.

i. When concealed, with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

10. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or other methods shall not be used to attach cables to cable supports.

11. Provide adequate pathways so that cabling is not forced to attach, be supported, or use other pathways not specifically designed and provided for. Any deviation from this will not be accepted.

    a. At no point shall cables come in contact with, be supported by, or attach to other trades equipment or supports.

    b. At no point shall cables come in contact with, be supported by, or attach to building structures or supports.

12. Provide appropriately sized sleeves where cables (supported by J-hooks) are required to pass through non-rated full-height partitions. Where allowed, sleeves shall extend a minimum of 3 inches beyond the partition surface on both sides, and shall be rigidly supported to support the weight of cables. Sleeves shall be sized so that no more than 40% of the cross-sectional area is utilized by the cabling to be installed.

13. Suspended cables shall be installed with at least 3 inches of clear vertical space above the ceiling tiles and support channels (T-bars).

14. Waterproofing

    a. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Architect and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.

    b. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost to the Owner.

15. Cutting and Patching

    a. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, layout the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc. using skilled tradespeople of the trades required at no additional cost to the Owner.

    b. Do not cut, channel, chase or drill masonry, tile, etc., unless permission from the Architect is obtained. If permission is granted, perform this work in a manner acceptable to the Architect.

c. Patch around all openings to match adjacent construction.

d. Where conduit or equipment is mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.

e. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost to the Owner.

f. After the final waterproofing membrane has been installed, roofs may be cut only with written permission by the Architect.

16. Mounting Heights

a. Mounting heights for equipment and devices requiring operational access shall conform to ADA requirements.

b. Wall mounted devices requiring operational access shall be mounted a minimum of 15 inches above finished floor to bottom of device and a maximum of 48 inches above finished floor to top of device.

c. Mounting heights shall be from floor to center of device, unless otherwise noted. Verify exact locations and mounting heights with the Architect before installation.

d. Typical mounting heights shall match nearest adjacent typical electrical outlet mounting height UON or as directed by the Architect.

17. Painting

a. Refer to Division 9 Section “Painting” for painting requirements.

b. Paint exposed ferrous surfaces, including, but not limited to, hangers, equipment stands and supports using materials and methods as specified under Division 9 of the Specifications; colors shall be as selected by the Architect.

1) If painting happens after cabling has been installed, cabling shall be masked off or otherwise protected so that cables are not painted. Paint on cables degrades the cable over time. PAINTED CABLES SHALL BE REPLACED with no additional cost to the owner.

c. Re-finish all field-threaded ends of galvanized conduits and field-cut ends of galvanized supports with a cold-galvanizing compound approved for use on conductive surfaces. Follow closely manufacturer’s instructions for pre-cleaning surfaces and application.

d. Factory finishes and shop priming and special finishes are specified in the individual equipment Specification sections.

e. Where factory finishes are provided and no additional field painting is specified, touch-up or refinish, as required by, and to the acceptance of, the Architect and Design Consultant, marred or damaged surfaces so as to leave a smooth, uniform finish. If, in the opinion of the Architect or Design Consultant, the finish is too badly damaged to be properly re-finished, replace the damaged equipment or materials at no additional costs to the Owner.

f. Provide touch-up paint as required by Specification Sections in this Division.

18. Fastenings

a. Fasten equipment to building structure in accordance with the best industry practice.

b. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.

c. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1) To Wood: Fasten with lag screws or through bolts.

2) To New Concrete: Bolt to concrete inserts.

3) To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.

4) To Existing Concrete: Expansion anchor fasteners.

5) To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.

6) To Light Steel: Sheet metal screws.

7) Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.

d. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Architect and conform to the following as a minimum:

1) Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.

e. For items, which are shown as being ceiling mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.

f. Areas identified as noise critical spaces shall have all penetrations sealed to minimize sound transmission between adjacent spaces.

B. Access to pathways and associated equipment

1. Locate all pull boxes, junction boxes and fire-rated pathway devices so as to provide easy access for operation, service inspection and maintenance.

2. Provide an access door/panel where equipment or devices are located above inaccessible ceilings. Where access doors/panels are necessary but not shown on the plans, coordinate type and location with Architect and Design Consultant through an RFI.

3. Maintain all code required clearances and clearances required by manufacturers.

C. Cable Distribution

1. For low-voltage cabling (that provides power at 70v or less), refer to section 2.1 above.

D. Conduits

1. Conduit shall be of the appropriate type required by code and as required by Electrical Division 26.

2. Adequate access shall be available where cables enter conduits

3. Bond and ground all metallic conduits and boxes in accordance with national or local requirements (ANSI STD-607 – “Commercial Building Grounding (Earthing) and Bonding Requirements For Telecommunications).

4. Install conduits in the most direct route possible, running parallel to building lines

5. Ream all conduit ends and fit them with an insulated bushing to eliminate sharp edges that can damage cables during installation or service.

6. Conduits which enter Telecommunications or Security/Equipment rooms shall extend 3 inches AFF or through the wall.
7. Flexible conduits may only be used where specifically allowed by these contract documents.
    a. Where indicated, flexible conduit sections shall be less than 20 feet in length.
8. No continuous section of a conduit may exceed 100 feet without a Pull Box.
9. No more than (2) 90° bends, or equivalent will be allowed between Pull Boxes.
    a. Each and any offset shall be considered a 90° bend.
    b. A Pull Box is required wherever a reverse bend is installed.
10. The minimum bend radius for conduits is:
    a. (6) times the inside diameter for 2 inches conduits or less.
    b. (10) times the inside diameter for conduits greater than 2 inches.
11. Conduits shall contain no electrical condulets (also known as LBs).
12. Underground Conduit Requirements
    a. Cabling and pathways serving devices exterior to the building, such as emergency phones/towers and security cameras.
    b. Requirements
        1) Refer to applicable details on drawings for illustrative requirements.
        2) Route all underground conduit so there is no more than (3) 90 degree bends, including stub-up bend at communications room/equipment cabinet.
            a) For underground conduit serving outlets/boxes outside the footprint of the building that require more than (3) 90 degree bends, provide appropriately-sized handhole(s). Coordinate location with Architect and Owner, indicate proposed location(s) on shop drawings, and include product information in pre-construction submittals. In general, handholes are NOT to be located in roadways, parking lots, sidewalks, or any location that may be subject to vehicular traffic.
            b) These underground conduits shall stub directly into the serving Communications Room/Equipment Room. If not, extend cabling within the building in IMC or RMC to the serving Equipment Room.
        3) Approved conduit types:
            a) When routed below slab-on-grade or outside the fooprint of the building:
                i) Horizontal conduit shall be RMC or Schedule 40 PVC a minimum of 12” below grade. If PVC is installed, also install tracer wire.
                ii) All vertical and horizontal bends and areas subject to vehicular traffic (loads) such as parking lots and roadways shall be RMC or concrete-encased PVC.

E. Outlet boxes
1. No outlet boxes shall be located back-to-back in a wall cavity.
    a. Where possible offset to next stud cavity, with a minimum of 6 inch separation.
2. Outlet boxes located in fire-rated walls are to have the appropriate firestopping for backboxes. These locations are to be identified on shop drawings.

3. Where cabling enters a backbox directly (not via conduit), provide black rubber grommet on knockout.

F. Pull Boxes

1. Pull Boxes shall be placed in Conveniently Accessible locations.

2. Coordinate the location and installation of all Pull Boxes to ensure adequate access is provided.

3. Pull Boxes above an accessible ceiling shall:

   a. Be aligned directly over the ceiling grid to allow access

   b. Be installed with a minimum of 3 inches (76.2 mm) clearance to ceiling grid and tiles

4. No directional changes shall be allowed in Pull Boxes. Conduit shall continue in the same direction as it enters and then change direction via an appropriately sized bend in the conduit.

5. Size Pull Boxes according to the following chart:

TABLE 1: Pull Box Sizing

Conduit Trade Size		Width	Length	Depth	Width Increase for Additional Conduit
1”	4”	4”	2-1/8”		N/A
1-1/4”	4”	4”	2-1/8”		N/A
1-1/2”	4”	4”	2-1/8”		N/A
2”	4”	4”	2-1/8”		N/A
2-1/2”	4”	4”	2-1/8”		N/A
3”	4”	4”	2-1/8”		N/A
4”	4”	4”	2-1/8”		N/A

3.2 LABELING

A. Labeling Installation

1. Labels are to be secured by adhesive. They shall have a type of adhesive that is appropriate for the particular surface upon which the label is to be installed. The mounting surface shall be free of dust, dirt, oil, etc. that would impede the adhesion of the labels.

B. Labeling Requirements

1. Labels are to be installed on or for:

   a. All firestopping systems. For wall and floor penetrations, label on both sides. See Firestopping later in this section.

   b. All pathways (e.g., conduit etc.) installed under this work.

      1) Label all conduit with “SECURITY”. Conduit labels shall utilize text readable from a standing position on the finished floor. Conduit sleeves which pass through a single wall or floor need not be labeled.

         a) For wall stub-up locations, label overhead only.

         b) For conduits greater than 10’, label both ends of conduit with far end location and Room/Number.

            i) Example – “Security to Panel 1 in Equipment Room 127”.

         c) For conduits that stub directly up or into an Equipment Room, label both ends of conduit.

            i) Example: underslab/ground conduit from Equipment Room 127 to Camera #13 attached to an exterior lightpole shall be labeled as follows:

               (1) Conduit stub-up location in Equipment Room 127 – “Security to Camera #13”.

(2) In the lightpole/junction box, immediately adjacent to serving conduit – “Security to Equipment Room 127”.

2) All pullboxes and junction boxes for Security shall be labeled “SECURITY PULLBOX” on the cover, such that the text is of sufficient size to be readable from a standing position on the finished floor.

a) Conduits entering and exiting all pullboxes and junction boxes shall be labeled with their destination/room number – ie “To Security Camera #17 in Room 114”.

c. In general, the label is to be provided and installed by whomever installed the item that is being labeled.

d. Refer to individual Division 28 sections and to the drawings for additional information on labeling requirements.

3.3 FIRESTOPPING

A. General

1. Provide fire resistant materials of a type and composition necessary to restore fire ratings to all wall, floor or ceiling penetrations; including membrane penetrations. All materials shall be classified or listed as a complete system by UL (or an approved NRTL by the Design Consultant and AHJ) and meet NEC and local codes. The use of partial systems or components of systems is not allowed unless specifically identified in the documents.

2. All penetrations through fire rated floors and walls shall be sealed to prevent the passage of smoke, flame, toxic gas or water through the penetration before, during or after a fire. The fire rating (F and T) of the penetration seal shall be at least that of the floor or wall into which it is installed, so that the original fire rating of the floor or wall is maintained as required by referenced building codes.

a. Assume all floors are fire-rated, unless otherwise noted.

b. Also install fire stops at any other locations indicated in the Specifications or Drawings.

3. Provide a label on both sides of fire rated assembly at all fire stop locations indicating:

a. Fire stop Manufacturer

b. Installer and company

c. Date installed

d. UL system number with all relevant ratings indicated

4. Include labels in each Equipment Room in which one or more fire-rated walls is installed. Provide a 2” block letter stencil label on the inside of the room to indicate rating for each barrier.

5. Provide systems as identified on the drawings and specified herein. At locations where the cabling routing encounters a fire-rated barrier provide an adequately sized fire stop device for the quantities and types for all cables to be installed plus 25% growth.

B. Penetration Sealant – Conduits

1. Provide listed system to seal around openings between wall, floor or partition around conduits in accordance with system listing and manufacturer’s instructions.

C. Penetration Sealant – Voids, Cavities, and Openings

1. Install fire stop materials in the framed openings through fire rated partitions per the Architect's drawings and in accordance with the NRTL listed system instructions.

2. Fire stop all voids, cavities, and openings left by the removal of cabling, conduits, conduit sleeves, cable trays or other equipment related to the communications systems not to be reused.

3. Install the fire stop system in accordance with the manufacturer's instructions and local codes.

D. Fire-Rated Pathway Device

1. Provide fire-rated pathway device anywhere cables are required to pass through fire-rated walls, floors or partitions.
2. Devices shall be installed in locations where required by the Contract Drawings, arranged individually or appropriately ganged.
3. Install the devices in strict accordance with the approved shop drawings and the equipment manufacturer’s recommendations.
4. Apply the factory supplied gasketing material (where required) prior to the installation of the wall plates.
5. Secure wall plates (where required) to devices per the equipment manufacturer’s recommendations.

END OF SECTION

SECTION 28 10 00

ELECTRONIC SECURITY SYSTEMS

PART 1 - GENERAL REQUIREMENTS

1.1 CONFIDENTIALITY NOTICE

A. Electronic Security System Work is confidential in nature. All drawings and relevant specification sections are considered confidential information and shall remain secure. Track all physical copies of Electronic Security System documents, restrict document access to those working directly on the project; properly dispose of the physical documents when no longer needed. Share and/or restrict access of electronic documents to only those working directly on the project having “a need to know”.

1. Proper disposal of physical documents means that they are crosscut shredded, incinerated, or pulped such that there is reasonable assurance the hard copy materials cannot be reconstructed.

2. These confidentiality requirements are a minimum. Follow local, state, and federal laws where more stringent.

1.2 SUMMARY

A. Provide a complete and functioning electronically controlled physical security system (“Electronic Security System”), and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system’s functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.

1. All Electronic Security Systems shall have a level of immunity to power interruptions, be time synchronized, and employ a level of redundancy or failure recovery so as to minimize the loss of data, monitoring, and control.

B. Specification sections 281000 through 283999, and Drawings numbered with prefixes TY , generally describe these systems, but the scope of the Electronic Security System Work includes all such Work indicated in all of the Contract Documents, including, but not limited to: Instructions to Bidders; Proposal Form; General Conditions; Supplementary General Conditions; Architectural, Structural, Mechanical, Plumbing, Electrical, Communications, and Fire Alarm System Drawings and Specifications; and Addenda.

C. The general scope includes, but is not limited to, these systems:

1. Provide a complete and functioning INTEGRATED Electronic Security System comprised of the following subsystems:

a. Intrusion Detection System

2. Provide time synchronization across all server and PC controlled and monitored Electronic Security System sub-systems. Where available, utilize the Owner’s time server for time reference.

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Section “General Electronic Safety and Security Requirements”.

C. Work under this section shall follow Division 28 Section “Common Work Results for Electronic Security Systems” for general pathway, firestopping, access panel, identification, and other requirements.

D. Requirements of this Section apply to all Sections 281000 through 283999 and vice versa.

1.4 CODES, STANDARDS, AND GUIDELINES

A. Follow the most current and up-to-date revisions or printings of the following codes and standards (UON):

1. NFPA 70 – National Electrical Code (NEC)
2. NFPA 101 – Life Safety Code
3. NFPA 730 – Guide for Premises Security
4. NFPA 731 – Installation of Electronic Premises Security Systems
5. IEEE National Electrical Safety Code (NESC)
6. IEEE 802.3af – POE standard
7. IEEE 802.3at – POE Plus standard
8. ANSI TIA-607-C – “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
9. ANSI/BICSI 005-2013 – Electronic Safety and Security System Design and Implementation Best Practices
10. ADA Standards for Accessible Design (2010)
11. BICSI Information Technology Systems Installation Methods Manual (ITSIMM)
12. BICSI Telecommunications Distribution Methods Manual (TDMM)
13. BICSI Electronic Safety and Security Design Reference Manual (ESSDRM)

1.5 ABBREVIATIONS

A.	BICSI	Building Industry Consulting Service International
B.	CCTV	Closed Circuit Television
C.	CPU	Central Processing Unit (computer)
D.	DESI	Detention Electronic Systems Integrator
E.	ESN	Electronic Security Network
F.	ESC	Electronic Security Contractor
G.	ESS	Electronic Safety & Security Designer, a BICSI designation
H.	NJATC	National Joint Apprenticeship and Training Committee
I.	OSP	Outside Plant
J.	PoE	Power-over-Ethernet
K.	RCDD	Registered Communications Distribution Designer, a BICSI designation
L.	RTPM	Registered Telecommunications Project Manager, a BICSI designation

M. TIA Telecommunications Industry Association

1.6 DEFINITIONS

A. Electronic Security Contractor (ESC) – The primary contractor of this and all related specification sections (281000 through 283999). The ESC is also responsible for fully coordinating all Electronic Security System requirements with other Divisions and sections, such as power, grounding/bonding, fire alarm, and pathways/other common work.

B. Equipment Grounding Conductor – as defined in the NEC, the conductive path installed to connect normally non-current-carrying metal parts of equipment together and to the system ground conductor or to the grounding electrode conductor, or both.

C. Equipment Room – A secured room either exclusively reserved for Security System headend equipment, or shared with other low-voltage systems such as Telecommunications headend equipment, Fire Alarm panels, etc.

D. Final Acceptance Review – the final site observation by Design Consultant; refer to Submittal paragraph (in Part 1 of this Section) and Project Close-Out Instructions (in Part 3 of this Section) for additional information / requirements.

E. Security Management System (SMS) - the central component for managing physical security and the bridge between physical and logical security for the project. The system shall provide a variety of integral functions including (but not limited to): regulation of access and egress; provision of identification credentials; monitor, track and interface alarms and; view, record and store digital surveillance video linked to SMS events.

F. System – short for Electronic Security System, all Work governed by this and related documents.

1.7 QUALITY ASSURANCE

A. Contractor Qualifications

1. ESC shall have a minimum five (5) continuous years in the business of integrating and/or installing Electronic Security equipment including but not limited to the systems identified with the Summary of Work paragraph of this Section.

2. Prior to bidding this project, the ESC shall be a certified installer by the equipment manufacturers whose products shall be incorporated into this project. Post-award certification will not be accepted.

3. ESC shall maintain certification by the manufacturers thru the duration of the warrantee period.

4. When requested, provide a list of projects (no less than 3) of similar size, scope and type in which the Bidder has performed in a capacity comparable to the size, scope and type outlined in these Construction Documents. Provide the project name, relevant project information for comparison evaluation, and contact names with telephone numbers of each such project.

5. Refer to individual sections for additional Contractor qualifications.

B. Personnel Qualifications

1. Provide and maintain a Quality Control Specialist on staff as a full-time employee at all time. This person shall be familiar with the project and available to attend all scheduled project meetings when required by the Owner/Design Consultant. This person shall conduct weekly inspections and approve all submittals and work performed. This personal shall possess one or more of the following:

a. BICSI RCDD or ESS Designer certification

b. Current ASIS Physical Security Professional (PSP) or Certified Protection Professional (CPP)

c. An individual with substantial industry experience (10+ years); submit a copy of this person's resume with Pre-Construction submittals and whenever requested.

2. Provide and maintain a qualified Project Manager, who shall be on-site at all times Work in this (and Related Sections) is being conducted and shall attend all scheduled project meetings. This person shall possess one or more of the following:

a. Current BICSI RCDD, ESS or RTPM certification.

b. Current ASIS PSP or CPP certification.

c. Level III Video Security Systems Technician certification by National Institute for Certification in Engineering Technologies (NICET) and be in good standing.

d. Technology-related degree from an ABET accredited institution.

e. An individual with significant industry experience as a project manager (5+ years); submit a copy of this person's resume with Pre-Construction submittals and whenever requested.

3. Any additional personnel that will be physically installing any part of the Electronic Security System shall, at a minimum, be in good standing as one of the following:

a. NJATC Installer Technician

b. BICSI Certified Level 1 Commercial Installer

c. NICET Level III Technician (audio, automation, or video)

d. Or be assigned to work under the direct supervision and direction of a person holding said certifications.

4. In addition, where required by state and local jurisdictions, any personnel working on-site shall be licensed, for security work or other work as required by this and related sections, and proof of licensure shall be submitted.

5. These requirements are provided as a minimum level of qualification. Any additional or more stringent requirements by the specific manufacturer chosen to provide the proper level or term of warranty as specified in this division shall be met.

6. Alternate qualifications may be considered. Provide requested alternate considerations prior to Bid in accordance with the Substitution Request instructions in Division 28 Section "General Electronic Safety and Security Requirements".

C. Warranties

1. Per Division 1, and unless otherwise noted in Division 28 specifications, ESC shall warrant all work to be free of defects in workmanship and materials for a period of 1 year from the date of Substantial Completion.

2. ESC shall provide a point of contact (phone number) for all warranty and service calls, such that the ESC will respond and be on-site within 12 hours of the first call, and the repair completed to the satisfaction of the Owner within 36 hours of arrival on site.

a. For issues not properly resolved within this timeframe or those that are unable to be resolved in the field, ESC may elect from the following (subject to approval of the Owner):

1) Provide temporary/loaner equipment of comparable function until such time that the component can be fixed or replaced.

2) Reimburse the Owner for additional security staff necessary to cover the down time of that part of the System.

3. All Warranty Work shall be completed by factory-certified technician(s) of the component(s) being address.

D. ESC shall visit the job 30 days prior to the end of the 1-year warranty period to check all equipment for proper system operation. Any defective equipment found shall be replaced or repaired under the terms of the system warranty.

1.8 WORK INCLUDED

A. Provide labor, materials, and accessories required to install, test and place into operation the Electronic Security System and all sub-systems as called for in the Contract Documents, and in accordance with applicable codes and regulations. Include labor, materials, and accessories not specifically called for in the Contract Documents but required to provide complete operating systems without additional cost to the Owner. The Work includes, but is not necessarily limited to, the general scope of work as presented in the Summary paragraph above.

B. The Work also includes, but is not necessarily limited to, the following:

1. Conduit, backboxes, pull boxes, firestopping, and other pathways necessary for the completion of all Electronic Security Systems – installed per Division 28 “Common Work Results for Electronic Security”; if another sub-contractor is providing the pathways/common work (as coordinated with the Prime Contractor), the Project Manager and/or Quality Control Specialist of this section shall coordinate and inspect the installation of all pathways/common work with that sub-contractor.
2. Cabling between the Electronic Security headend equipment and field devices, and between multiple Equipment Rooms.
3. Full build-out of Equipment Rooms, including all terminations, patch panels, patch cords, cabinets, equipment racks, ladder rack, backboards, etc. Where equipment rooms and pathways are shared with other systems, such as Telecommunications and/or Audio Video, coordinate Division of Labor for shared infrastructure.
4. A grounding/bonding system, as described in these construction documents, required by equipment manufacturers, and referenced codes and standards.
5. Appropriate cable supports as required by these construction documents, such that all cabling external to Equipment Rooms is either installed in conduit or supported via J-hooks or cable tray every 48 to 60”.
6. For cabling in Equipment Rooms, cable from field devices shall consolidate in an overhead junction box above the equipment panels and be routed in conduit from this junction box into the control panels.
    a. This is not a requirement for telecommunications cabling required for Work under this Division. Refer to Division 28 Section “Telecommunications Requirements for Electronic Security” for pathway requirements within Equipment Rooms.
7. Seismic bracing of all cabinets, equipment racks, cable trays, conduit, etc. provided under this Work as required by code and by the AHJ.
8. Testing, labeling, and documentation of all cables and hardware installed under this Division.

C. Prepare and submit shop drawings, testing reports, as-built drawings, and cabling documentation in a timely manner to conform to all project schedules and timelines.

1. Submittals are a crucial requirement to a successful project. No work may begin until Pre-Construction Submittals have been approved by the Design Consultant.
2. Incomplete submittals, including submission of unedited bid drawings as shop drawings, will be immediately rejected and not reviewed.

3. The first Pre-construction Submittal shall be of such detail and thorough enough to demonstrate to the Design Consultant and Owner that the ESC understands the project requirements and for installers to have sufficient information to complete construction in accordance with the contract documents.

    a. The project schedule is dependent upon the first pre-construction submittals being thorough enough that only minor edits (if necessary) will be required to be resubmitted.

4. Accurate Record Drawings and other close-out documentation are integral to the Owner's use and maintenance of the system, and are to be submitted prior to the Final Acceptance Review.

1.9 COORDINATION

A. The locations of outlets, devices, panels, equipment racks and other equipment indicated on the Drawings are approximate and are understood to be subject to such minor revision as may be found necessary or desirable at the time the work is installed in order to meet field conditions, coordinate with modular requirements of ceilings, simplify the work, establish sight lines for cameras, improve visibility for interactive security devices, or for other legitimate causes.

B. Exercise particular caution with reference to the location of outlets, devices, control panels, switches, etc. Verify with the Architect the exact location and mounting height of outlets, devices and equipment not dimensionally located on the Drawings.

C. The Drawings show only the approximate locations of outlets and devices, and, if shown, general run of raceways. Any significant changes in location of outlets, devices, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Architect for review before such alterations are made. Except for unforeseeable extenuating circumstances, modifications shall be made at no additional cost to the Owner.

D. Camera, door, and device tags in the form of alpha/numeric characters are used where shown to indicate the designation numbers for identification purposes at the equipment panels and/or patch panels. Show the actual camera, door and device numbers on the as-built Record Drawings, on the associated typed field labels and in the printed and computer readable cabling and device schedules. Submit sample camera, door, and device information tags (proposed labeling scheme).

E. The drawings do not indicate the number of cables in conduit, or the actual identity of cables in specific conduits, cable tray or other cabling pathways. Under no circumstances shall 40 percent raceway fill be exceeded, regardless of the type of cabling installed.

F. Provide the correct cable type and quantity as required by the indicated outlets, devices, cable schedules, the design intent of any example drawings or schedules, referenced wiring diagrams (if any), the maximum distance limitations, and the applicable requirements of the NEC and ANSI TIA-569.

G. All cabling shall be installed complete and unspliced from field device termination to headend termination, unless otherwise noted.

H. All cabling installed in Damp or Wet Locations (as defined by the NEC) shall be wet-rated / listed for installation in a Wet Location.

    1. Underground pathways for devices exterior to the building shall stub up directly in the serving Equipment Room; if conduits stub up elsewhere in the building, a junction box is required in an accessible ceiling location and the cabling shall transition from wet-rated to plenum- or riser-rated cabling (per Division 28 Sections "Conductors and Cables for Electronic Security" and "Telecommunications Requirements for Electronic Security").

I. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment.

1. At a minimum, coordinate the following with the Division 26 Contractor:

    a. All electrical circuits serving Electronic Security System equipment shall be supplied with an Equipment Grounding Conductor for each circuit.

    b. All electrical circuits serving Electronic Security System equipment shall have dedicated neutrals (no shared neutrals between branch circuits).

J. Within two weeks after the Notice to Proceed, schedule a meeting with the Owner's IT and Security staff to coordinate network requirements and programming of the Electronic Security Systems.

1. Refer to Division 28 Section "Network Requirements for Electronic Security" for additional coordination requirements with the Owner's IT staff.

1.10 SUBMITTALS

A. Refer to requirements in Division 28 Section "General Electronic Safety and Security Requirements". At a minimum, follow these additional requirements:

1. Pre-Bid Submittal (due at the questions deadline during the bid window)

    a. Substitution Request for any one of the following:

        1) Product Substitutions

        2) Alternate Personnel Qualifications

        3) Contractor Qualifications (for ESCs wishing to be added to the Pre-qualified Contractors list)

2. Pre-Construction Submittal

    a. Refer to Division 28 Section "General Electronic Safety and Security Requirements" for general Pre-Construction Submittal instructions / requirements.

    b. Submit the following information for all Electronic Security Work together (Division 281000 through 283900) at the same time, with information grouped in the following categories, then identified by section and in the exact order of the specifications:

        1) Cover Page, which includes name of ESC and contact name, phone, and email of the following:

            a) Quality Control Specialist

            b) Project Manager

        2) Division of Labor

            a) Indicate any sub-systems – such as Common Work (conduit, backboxes, etc.), cabling, structured cabling – that will either be provided by a sub-contractor to the ESC or to the Prime Contractor. Indicate the company name that is provided each sub-system.

        3) Schedule

            a) Gantt chart format; coordinate with Prime Contractor as needed.

        4) Equipment List

            a) Typed list in the following format:

                i) Product name / type

                ii) Manufacturer

                iii) Model name

iv) Model number

v) Manufacturer Warranty Term (wherever longer than 1 year)

b) Separated by specification section and in the exact order as listed in the specification sections.

5) Cut Sheets

a) Separated by specification section and in the exact order as listed in the specification sections.

6) Shop Drawings

a) Scaled floor plans, at not less than 1/8" = 1'-0" scale, to identify the following:

i) Room names and numbers

ii) Door numbers (to match the Architect's Door Schedule)

iii) Conduit, firestopping, cable tray, and other common work locations, sizes and routing, as required by Division 28 Section "Common Work Results for Electronic Security Systems",

iv) Cable type, quantities, routing, and approved identification,

v) Equipment Room locations and serving areas,

vi) Dimensioned device locations and approved identifiers,

vii) Where the System controls electronic door hardware, identify type (of electronic door hardware) and voltage for each door.

b) Enlarged scaled floor plans and elevations, at not less than 1/4" = 1'-0" scale, of Equipment Rooms, showing 3' of clearance space in front of all panels and wall-mounted racks/cabinets and 3' of clearance space in front of and behind all floor-mounted racks/cabinets.

c) Details of the following:

i) Termination, or pin-out, details of multiple or multi-conductor cables at the Device and Equipment ends for each type of device.

ii) Riser, block, functional, and grounding/bonding diagrams for all systems and sub-systems.

c. Refer to individual sections in this Division for additional Pre-Construction Submittal requirements.

3. Preliminary Project Completion Submittal

a. A minimum of 1 week prior to the Final Acceptance Review, submit "Division 28 Electronic Security – Preliminary Project Completion Submittal", to include the following documentation:

1) Resubmit approved Pre-Construction Submittals of the following, updated to reflect all changes during construction:

a) Equipment List

b) Cut Sheets

c) Preliminary Record Drawings – based on drawings kept on site.

i) Scans of on-site drawings are acceptable, provided notes and minor changes are legible

ii) These drawings shall include the actual installed device and cable IDs that correspond to submitted test results.

2) Submit the following additional items (as part of each sub-system):

a) Operation and Maintenance Manuals

b) Test Results for all sub-systems.

i) Device and cable IDs shall correspond to submitted Preliminary Record Drawings.

3) And additional items as required in other Division 28 Electronic Security specification sections.

b. Refer to the Project Close-Out Instructions in Part 3 of the section for additional information and requirements.

4. Final Project Completion Submittal

a. After Final Acceptance Review and before Substantial Completion:

1) Address all Punch List items generated from Final Acceptance Review,

2) Retest effected items

3) Conduct Owner Training and deliver any spare parts / physical items to Owner.

b. Submit the following additional items as part of “Division 28 Electronic Security – Final Project Completion Submittal”:

1) Cover Page – to include ESC company name and contact information for Warranty issues

2) (Updated) Equipment List (with length of manufacturer warranty that extends beyond 1 year), Cut Sheets, Operation & Maintenance Manuals, and Test Results

3) (Updated) Record Drawings, in AutoCAD and searchable PDF file formats

4) Spare Parts / Physical Media Confirmation – included scanned PDF of written confirmation from Owner that all spare parts and physical media were furnished to Owner at the time of Owner Training.

5) Manufacturer Warranty Information and Certificates

c. Refer to the Project Close-Out Instructions in Part 3 of the section for additional information and requirements.

d. Refer to individual sections in this Division for additional Project Completion Submittal requirements.

PART 2 - PRODUCTS AND MATERIALS

2.1 NOT USED

A. Refer to individual Electronic Security System sections for product requirements.

PART 3 - EXECUTION

3.1 IDENTIFICATION / LABELING

A. General Requirements

1. The inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited.

2. Required UL labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

B. Refer to individual Electronic Security System sections for additional requirements.

3.2 START-UP OF SYSTEMS

A. Prior to system start-up, conduct or ensure the following safeguards:

1. Check all electrical circuits of the various devices for proper wiring polarity, grounding, and activation.
2. Verify that equipment is effectively bonded and grounded to earth.
3. Ensure all Equipment Rooms are properly conditioned and free of dust or other contaminants.
4. Coordinate with Owner's IT department per Division 28 Section "Network Requirements for Electronic Security".

3.3 PROJECT CLOSE-OUT INSTRUCTIONS

A. Functional Testing

1. Conduct and finish functional tests of all sub-systems, and integrated testing where applicable. Correct any and all functional issues prior to requesting the Final Acceptance Review by the Design Consultant.

B. Preliminary Project Completion Submittal

1. Submit the following at least 1 week prior to requesting the Final Acceptance Review:
    a. A copy of Pre-Construction Submittals updated with all changes made during construction.
        1) If changes noted on the jobsite work prints are readily legible, a scanned copy is sufficient at this time.
        2) Otherwise, obtain reproducible electronic copies of the final Drawings and incorporate changes noted on the jobsite work prints onto these drawings. These changes shall be done electronically in BlueBeam*, AutoCAD or BIM software and saved to PDF format. Each sheet shall contain the ESC's name/logo and be identified as "Preliminary Record Drawing".
            a) *Final Record Drawings shall be created in AutoCAD or BIM software; annotated PDF drawings will not be accepted.
    b. Detailed Test Reports of the following sub-systems:
        1) Grounding and Bonding per Division 28 Section "Equipment Room Fittings for Electronic Security".
        2) Functional Test Reports per individual sections for the following:
            a) Intrusion Detection
    c. Copy of the Operation and Maintenance Manuals for each specified piece of equipment.

C. Final Acceptance Review

1. Upon completion of all functional testing, request in writing a Final Acceptance Review; this is a final site observation by the Design Consultant. Give the Architect and Design Consultant at least seven (7) days' notice prior to the review. Make the request sufficiently enough in advance for the review to properly be scheduled and completed such that punch list items can be addressed before substantial completion.

2. State in the written request that the Contractor has complied with the requirements for Substantial Completion.

3. Upon receipt of a request for review, the Architect will either proceed with the review or advise the Contractor of unfilled requirements.

4. During the Final Acceptance Review, provide the following:

    a. Services of the Project Manager, as identified in the Quality Assurance part of this Specification Section, and a minimum of two other technicians familiar with the project. The Project Manager shall facilitate the review and demonstration of the Electronic Security System and all sub-systems as requested by the Design Consultants.

        1) Provide a minimum of two cell phones or radios to allow two-way communication between the headend or Workstation location and a mobile technician to trigger various security alerts.

    b. Ladders, lifts, and/or scaffolding as required to reach all cameras or other high-mounted devices.

    c. Specific test equipment used during the Contractor's preliminary testing activities, and the services of qualified technicians to operate such test equipment.

        1) Per individual sections, the Design Consultant may request the Contractor conduct random retesting to confirm the documented test results.

        2) Refer to individual sections for exact requirements.

5. If the Contractor requests a Final Acceptance Review prior to completing the requirements of the Contract Documents, then provide reimbursement to the Design Consultant for time and expenses incurred for the visit.

6. Upon completion of the review, the Design Consultant will prepare a "punch list" of outstanding items not in compliance with the Contract Documents, to be completed or corrected for final acceptance.

    a. Omissions on the "punch list" shall not relieve the Contractor from the requirements of the Contract Documents.

D. Owner Training

1. Conduct in-person training for the Owner in operation and general maintenance for all Electronic Security System and sub-system equipment. Assume a single 2-hour training session for the following sub-systems, unless otherwise noted:

    a. Intrusion Detection

E. Punch List Completion

1. Complete all punch list items before Substantial Completion.

2. Retest affected items.

3. Update Preliminary Project Completion Submittal with all changes.

F. Project Completion Submittal

1. At the completion of the project, compile the following electronic files, divided into the following sub-folders:

    a. Equipment List, in PDF and Microsoft Excel format, to include:

        1) Specification Section number

        2) Quantity

3) Manufacturer

4) Part Number

5) Serial Number

6) Manufacturer's warranty end date, if greater than 12 months after Substantial Completion

b. Cutsheets and Operation and Maintenance Manuals

c. Test Results and Cable Databases, in PDF and Microsoft Excel format

d. Record Drawings, in PDF and AutoCAD file formats

e. Spare Parts / Physical Media

1) Copy of written documentation indicating that the spare parts were furnished to the owner.

2. All products and submittals are to be in the exact order as these specifications.

3. Cutsheets and O&M Manuals are to be separate files identified by ## - Product Name – Manufacturer – Model.pdf, where ## is the sequential order of the product in that specification. Example (manufacturer and products may be different for this project):

a. 01 – Headend System – Lenel – OnGuard – 7.2

b. 02 – Server Software – Lenel – OnGuard – SWS-32ES

c. 03 – Workstation – Dell – Precision T3500

d. 04 – Controller – Lenel – Intelligent Dual Reader

e. 05 – Interface Module – Lenel – Dual Reader Interface Module

f. 06 – Power Supply – Altronix – Multi-Output Power Supply

g. 07 – Card Reader – HID – Multi-class Reader

h. 08 – (continue as needed)

4. Test Results and Cable Database requirements are to include the following:

a. Test Results to include PDF of passing Functional Test Report for each device, organized by sub-system. Refer to individual sub-sections for Functional Test Report requirements.

b. Cable Database requirements – refer to Division 28 Section "Conductors and Cables for Electronic Security" and "Telecommunications Requirements for Electronic Security"; these are to be submitted in PDF and Microsoft Excel file formats.

5. Record Drawings

a. Refer to Record Drawings paragraph in Division 28 Section "General Electronic Safety and Security Requirements" for additional requirements.

b. Record Drawings shall be updated versions of the approved Shop Drawings and shall meet all Shop Drawing requirements.

c. Record Drawings for each Electronic Security sub-system shall be provided with final cable routing and pathway routing noted.

1) J-hook / cable routing shall be indicated.

2) Conduit and pullbox routing and locations shall be indicated.

6. After Design Consultant makes comments on the Final Project Completion Submittal, incorporate changes and:

a. Save a copy of these files onto the Workstations provided by the ESC.

b. Forward updated Final Project Completion Submittal files to Owner. Include file path information for these updated files on the Workstations provided by the ESC.

END OF SECTION

SECTION 28 10 10

CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. As part of a complete and functioning Electronic Security System and associated infrastructure, provide conductors and cables of appropriate type. This section includes:

1. Low-voltage Control and Power Cables

B. Conductor and cable requirements are unique to each manufacturer equipment / device. Unless otherwise noted, exact conductor and cable types are to be coordinated by the ESC to meet the requirements of the Electronic Security manufacturer

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”.

C. Conductors and cables as specified in this section shall be supported and installed into pathways, backboxes, firestopping, and other general/common work per Division 28 Section “Common Work Results for Electronic Security Systems”.

D. Refer to Division 27 Specifications for all Category 6 and Fiber Optic Cable requirements.

E. Refer to Division 28 Section “Equipment Room Fittings for Electronic Security” for grounding and bonding requirements.

F. Refer to individual Electronic Security System sections for additional conductor and cabling requirements.

1.3 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”.

B. The following additional requirements at due at the following submittal phases:

1. Pre-Construction Submittal

a. Cut sheets shall contain the following information for each of the cables specified.

1) Manufacturers name and logo

2) Cable outside diameter

3) Number of conductors/strands in each cable and binder group

4) Gauge or strand thickness

5) Cable jacket material and rating (ie Plenum, Riser, wet-rated, etc.)

6) Maximum pulling tension

7) Jacket/Sheath color

8) Individual conductor or strand insulation colors (if applicable)

9) Minimum bend radius

a) During installation and post installation, if it differs.

b. Shop Drawings

1) Cable types required by this Section are to be identified on Shop Drawings for the following Electronic Security sub-systems: (separate 281010 Shop Drawings for this section are not needed)

a) Intrusion Detection

2) On the Shop Drawings for those Electronic Security sub-systems, show the proposed routing of all conductors and cables and the means of support:

a) Cable Tray

b) Conduit (solid line)

c) J-hooks every 48”-60” (dashed line), if allowed by Contract Documents

3) On the Shop Drawings for those Electronic Security sub-systems, include details showing the proposed termination and labeling (ID) scheme at each device and panel for each conductor/cable.

2. Preliminary Project Completion Submittal

a. Follow all requirements as specified in Division 28 Section “Electronic Security Systems”.

b. Update the approved shop drawings with any changes in cable routing, and submit as part of Preliminary Record Drawings per Division 28 Section “Electronic Security Systems”.

c. Test Results

1) Include conductor/strand test as part of the Functional Test Reports for each Electronic Security sub-system.

d. Cable ID spreadsheet, saved in PDF and Microsoft Excel file formats, which shall include the following for each cable installed under this section:

1) Electronic Security Sub-System

2) Device Type

3) Device Identifier

4) Device Room Number (if not part of Device Identifier)

5) Headend Panel Identifier

6) Headend Panel Room Number (if not part of Headend Panel Identifier)

7) Cable Identifier

TABLE 1: CABLE IDENTIFICATION SPREADSHEET

Sub-System	Device Type/ID	Device Rm	Headend ID	Headend Rm	Cable ID
Access Control	Card Reader 01	Vestibule 101	ACP-01	IDF 114	AC-CR01-ACP01

3. Final Project Completion Submittal

a. Follow all requirements as specified in Division 28 Section “Electronic Security Systems”.

b. Incorporate any changes from punch list items.

c. Include updated Cable ID spreadsheet.

1.4 DEFINITIONS

A. Damp Location – as defined by the NEC, locations protected from weather and not subject to saturation with water or other liquids but subject to moderate degrees of moisture. For the purposes of Work under this division, assume all Damp Locations require wet-rated cabling.

B. Point of Entrance (Building Entrance) – as defined by the NEC, the point within a building where the security cabling routed through a Wet Location emerges from an external wall, a concrete floor slab, or IMC/RMC.

C. Qualified Electrician – one who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved; in regards to this project, a Qualified Electrician is also licensed in the jurisdiction of the project to install electrical equipment (ie Journeyman or Master Electrician License).

D. Wet Location - as defined in the NEC, installations underground or in concrete slabs or masonry in direct contact with the earth; in locations subject to saturation with water or other liquids, such as vehicle washing areas; and in unprotected locations exposed to weather.

PART 2 - PRODUCTS AND MATERIALS

2.1 GENERAL REQUIREMENTS

A. Conductors and cables shall meet the following the requirements:

1. UL Listed and Approved for the intended application

   a. Where areas above accessible ceilings are serving as plenum (air) return, and conductors/cabling is not installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Plenum (CMP) rated.

   b. Where conductors/cabling are installed in conduit from device to serving panel or Equipment Room, the conductors/cabling shall be Riser (CMR) or Plenum rated.

   c. Where conductors are/cabling are routed through a Wet Location,

2. Cable type and conductor size/quantity shall be as recommended or required by the device/equipment manufacturer. Where the Contract Documents differ from manufacturer recommendations or requirements, notify the Architect requesting clarification.

3. Conductor sizes, if shown, are minimum. Where approved by the Design Consultant and at no extra cost to the Owner, larger conductor sizes may be installed at Contractor's option in order to utilize stock sizes, provided raceway sizes are increased to correspond with fill ratio requirements defined the NEC.

4. Conductors and cables shall be shielded.

   a. Submit RFI for any manufacturer equipment that recommends non-shielded cable.

B. The following Manufacturers are conditionally approved:

1. Belden

2. Draka

3. General Cable

4. Tappan

5. West Penn Wire

2.2 LOW-VOLTAGE CONTROL AND POWER CABLES

A. For 10 AWG through 24 AWG, and single conductors through 24-pair applications, as needed per project.

B. General requirements:

1. Shielded (overall shield)
2. Stranded and insulated conductors
3. PVC jacket
4. Size conductors per manufacturer recommendations and power/voltage drop based on installed cable length.

C. Manufacturer shall be:

1. Submit product cutsheets concurrently with Shop Drawings, identifying cable type, manufacturer, and part number on the Riser Diagram.
    a. Call out non-plenum (Riser-rated and Wet-rated) cables (where specifically allowed)

PART 3 - EXECUTION

3.1 CABLE INSTALLATION

A. Pre-Installation

1. Following the Notice to Proceed, the ESC's Quality Control Specialist or Project Manager (as defined in Division 28 section "Electronic Security Systems") shall coordinate with the Contractor or Sub-Contractor responsible for Division 28 "Common Work Results for Electronic Security Systems" (ie the conduits, backboxes, etc), if Contractors are different. Items of coordination shall include, but are not limited to:
    a. Conduit routing
    b. Conduit type for Building Entrance(s) – (see requirements below)
2. Conduit routing and type shall be indicated on at least one of the following Pre-Construction Shop Drawings:
    a. Division 28 "Common Work Results for Electronic Security"
    b. Division 28 "Electronic Security Systems"
3. After conduits/pathways are installed, but prior to cable installation, ESC's Quality Control Specialist and Project Manager shall inspect the Common Work (pathways and backboxes), paying special attention to:
    a. Conduit sizes and quantities matches Construction Documents and Project requirements
    b. Minimum bend radius
    c. Quantity of bends in conduit between pullboxes (180 degree change in direction, maximum)
    d. Building Entrance conduits are of appropriate type
    e. Any visible indication of improper or incomplete installation that may damage cable as it is installed.

B. General Requirements

1. Unless otherwise noted, all cables shall be routed through concealed conduit raceway.
    a. Conduits are not required above accessible (drop) ceilings; when not installed in conduit, cables shall be supported via j-hooks every 48 to 60 inches or less and at every change in direction. For areas where accessible ceiling is not available for pathway back to the Equipment Room, cables may be consolidated and routed in overhead conduit and conduit sleeves.
    b. Contractor is responsible for determining final cable and conduit routing; conduits may be consolidated in overhead pullboxes in accordance with Division 28 Section “Common Work Results for Electronic Security”; proposed (cable and) conduit routing and sizing shall be indicated on pre-construction shop drawings.
2. Install continuous conductors between outlets, devices and boxes without splices or taps. Do not pull connections into raceways. Leave at least 12 inches of conductor in backbox at each device location.
3. A Qualified Electrician shall install all control wire operating at 120V nominal and above. Control wiring operating at less than 120V (e.g., 12V and 24V) may be installed under the Division furnishing it.
4. All cables shall be riser-rated, unless noted otherwise.
5. Cables shall remain unattached to pathways or other cables and shall simply lay at rest on the supports provided by its pathway (including cable trays, wire basket, j-hooks, conduit, etc.). Wire ties, velcro straps, electrical tape or any other method shall not be used to attach cables to cable supports or to create cable bundles.
    a. Except when supported by ladder racking within each Telecommunications room, UON.
6. At the same time horizontal cables are pulled into a conduit also install a pull cord to facilitate future cable pulls along those. Use polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inches of slack at each end of pull cord.
7. Do not install kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable
8. Comply with all referenced standards and guidelines.
9. Cables shall be masked, covered, or otherwise protected from being painted or coming in contact with any other substance that may degrade the performance or physical characteristics of the cable jacket or insulation over time.
10. Where space allows, all cables shall be provided with slack/service loops near each end of the cable, one in the accessible ceiling space or overhead J-box at the device and one at the Equipment Room. Each slack/service loop shall be:
11. A minimum of 3 feet (1 meter) in length, unless noted otherwise.
12. Prior to using any cable pulling lubricants provide the Design Consultant with written documentation from the cable manufacturer supporting the cable manufacturers’ acceptance of its use in compliance with all required warranties as part of these contract documents. The use of non-water based lubricants shall be provided when pulling PVC jacketed and all cables not suitable for contact with water.
13. Install all cables and conductors in compliance with the requirements of Article 725 of the NEC, paying special attention to the following:
    a. Cables shall be installed in a neat and workmanlike manner.
    b. Separation requirements dependent upon installation location and proximity to other circuits.

C. Outside plant (OSP)/wet-rated cable installation: for cables placed in Wet Locations or as required by these construction documents. (I.e. all cables which extend beyond the footprint/envelope of the building or pathways leading to floor-boxes embedded in a ground floor slab)

1. No portion of outdoor only (unlisted) cables may be installed with the cable jacket exposed in any plenum or other air handling space nor shall they be allowed to transition between different levels of the building.

2. Rigid or intermediate metallic conduit shall be used to route outdoor (unlisted) cabling to the serving Equipment Room in accordance with the NEC; or a suitably-sized junction box shall be provided in an accessible location within 50' of where the outdoor cabling/conduit enters the building enters the building to allow the cable to transition from wet-rated to plenum-rated.

   a. Indicate this location on pre-construction shop drawings and final Record Drawings.

3. All cables which extend beyond the envelope/footprint of the building shall be installed with entrance protectors in accordance with Division 28 Section "Equipment Room Fittings for Electronic Security".

3.2 CABLE IDENTIFICATION

A. Label all cabling with machine-printed labels according to the labeling scheme identified on the drawings or as described in Division 28 Section "Electronic Security Systems". Where the drawings and specifications are silent, submit RFI through appropriate channels requesting labeling scheme.

1. Shop drawings shall include floor plan and/or riser diagram that indicates proposed cable/device identification for each device.

B. Cables shall be labeled within 6" at each end.

C. All cable labels shall be thermal-transfer type and utilize self-adhesive labels. The following are approved manufacturers:

1. Brady, IDXPERT
2. Hellermann Tyton, Spirit 2100
3. Panduit LS9
4. Or equivalent

3.3 GENERAL CABLE TESTING

A. Pre-installation testing:

1. Visually inspect all cables, cable reels/boxes, and shipping cartons to detect cable damage incurred during shipping and transport. Return visibly damaged items to the manufacturer.
2. Do not install any cable with less than the manufacturer's guaranteed number of serviceable conductors.

B. Post-installation testing (but prior to termination to devices/panels):

1. Conduct cable continuity testing upon completion of installation on each conductor.
2. Remove all defective cables from pathway systems. Do not abandon cables in place.

3.4 CABLE TERMINATIONS

A. Cable connections to device and security panel shall be soldered and heat-shrunk from jacket to jacket. Exposed conductors, even within an enclosure or backbox, are not allowed.

3.5 ACCEPTANCE

A. The ESC's Quality Control Specialist shall conduct an inspection after conductors and cabling have been installed to ensure compliance with the Construction Documents and project requirements.

B. Functional tests of the conductors and cables connected to equipment will be conducted by the ESC as part of Test Reports as specified in Division 28 "Electronic Security Systems" and individual Electronic Security sub-system Sections.

END OF SECTION

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SECTION 28 10 20

EQUIPMENT ROOM FITTINGS FOR ELECTRONIC SECURITY

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Section includes fittings that are within the physical walls of Electronic Security Equipment Rooms (Communications Rooms), unless otherwise noted. Fittings include but are not limited to

1. Plywood backboards
2. Entrance protection
3. Cabinets, racks, and enclosures
4. Cable management
5. Power-over-Ethernet Extenders
6. Rack-mounted power equipment
7. Grounding/bonding requirements

B. Section does not specify fittings such as cables, cable terminations, termination blocks, and patch panels for telecommunications systems. These components are specified Division 27.

C. Section does not specify wall-mounted Electronic Security panels or rack-mounted Electronic Security network equipment such as switches or servers. Refer to other Division 28 Sections for those sub-system requirements.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Section “General Electronic Safety and Security Requirements”.

C. Work under this section shall follow Division 28 Section “Common Work Results for Electronic Security Systems” for general pathway, firestopping, access panel, identification, and other requirements.

D. Work under this section shall follow Division 28 Section “Electronic Security Systems”. All submittals associated with this section shall be submitted as part of a single Electronic Security Systems submittal.

1.3 DEFINITIONS

A. Communications Entrance Protection – Fittings that reduce risk to life, limb, or property by protecting against power surges. This definition shall encompass protection devices and fittings described in Article 770 “Optical Fiber Cables and Raceways” and Article 800 “Communications Circuits” of NFPA 70 “National Electrical Code”.

B. Cabinet – A floor or wall mount unit enclosed with side panels. Communications equipment is supported by mounting rails separated at 19” or 23” inches.

C. DVR – digital video recorder

D. Ground or Grounding – A conducting connection, whether intentional or accidental, between an electrical circuit (e.g. telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.

E. NVR – network video recorder

F. POE – Power-over-Ethernet

G. Rack – A floor or wall mount unit without side panels. Racks can be constructed with 2 or 4 vertcial posts. Rack-mounted equipment is supported by mounting rails separated at 19” or 23” inches.

H. RU – Rack Unit (1.75 inches high)

I. Telecommunications Grounding Busbar (TGB) – A busbar placed in a convenient and accessible location in an Equipment Room and bonded by means of the bonding conductor to the building service equipment (power) ground.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of device from a single manufacturer and through one source. Where practical and possible, obtain all devices from a single manufacturer and one source.

B. Equipment room fittings shall be listed by a NRTL.

1.5 SUBMITTALS

A. Follow the requirements for submittals in Division 28 Sections “General Electronic Safety & Security Requirements” and “Electronic Security Systems”.

B. Pre-Bid Submittal - the following submittals are due before the questions deadline before Bid:

1. For all products for which a substitute is to be considered as an approved equivalent or acceptable substitution, provide submittals with sufficient detail for review by the Design Consultant. Submittals shall at a minimum provide detailed information substantiating all performance requirements as well as all necessary code compliance and NRTL listing information.

C. Pre-Construction Submittal

1. Refer to Division 28 Section “Electronic Security Systems” submittal requirements, with additional requirements as noted:

a. Product Submittals (as part of complete Division 28 “Electronic Security Systems” Pre-Construction Submittal):

1) Product Cutsheets

a) For projects with Seismic-rated Equipment Racks and Cabinets, provide manufacturer’s Seismic Qualification Certificates verifying the product’s compliance with NUSIG-Telcordia CORE Zone 4 standards.

b. Shop Drawings (as part of complete Division 28 “Electronic Security Systems” Pre-Construction Submittal):

1) Enlarged Plans for each Equipment Room, at no smaller than 1/4" = 1’-0” scale, showing 3’ of clearance in front of all wall-mounted equipment and 3’ of clearance in front of and behind each floor-mounted equipment racks and cabinets.

2) Equipment rack and cabinet elevations, at no smaller than 1/2" = 1’-0” scale, identifying each piece of rack-mounted equipment by product name, manufacturer, and part number.

D. Preliminary Project Completion Submittal

1. Refer to Division 28 Section “Electronic Security Systems” submittal requirements, with additional requirements as noted:

a. Test Results

1) Include Test Report for all UPS units.

E. Final Project Completion Submittal

1. Refer to Division 28 Section “Electronic Security Systems” submittal requirements, with additional requirements as noted:

a. Test Results

1) Include Test Report for all UPS units.

b. Record Drawings

1) Grounding and Bonding

a) Add written confirmation that all required bonding connections have been made and the resistance tested to be 10 milli-ohms or below.

PART 2 - PRODUCTS AND MATERIALS

2.1 PLYWOOD BACKBOARD

A. Where Electronic Security System equipment is co-located in a Communications Room with telecommunications equipment, plywood backboard shall be provided by Division 27 “Structured Cabling System”.

B. Requirements:

1. Line walls as indicated with 4’ x 8’ sheets of 3/4” thick fire-retardant plywood.

a. Fire-retardant specification shall be one of the following:

1) Fire Retardant Treated Wood (FRTW), also known as Dricon

2) A-C grade plywood painted with two-coats of white fire-retardant paint

2. Plywood shall be A-C grade and void free.

C. Manufacturer shall be:

1. Shaw Stewart Lumber Company: AC Grade, 3/4" Thick, Dricon FRTW Fir Plywood

2. Equal from Fortress Wood Products
http://fortresswood.com/commercial-products.html

3. Equal from Wood Preservers
http://www.woodpreservers.com/dricon-fire-retardant-treated-wood.php

4. Equal from Exterior Wood
http://exteriorwood.com/dricon.htm

5. Or A-C grade plywood painted with two-coats of white, fire-retardant paint

2.2 ENTRANCE PROTECTION

A. General

1. Refer to Division 28 section “Intrusion Detection” for surge protection devices for Intrusion detection site devices.

2.3 RACKS, CABINETS, AND ENCLOSURES

A. Two-Post Rack

1. Where Electronic Security System equipment is co-located in a Communications Room with Telecommunications equipment, Two-Post Floor Racks shall be provided by Division 27 “Structured Cabling System”. Coordinate installation of Electronic Security equipment into Rack with Division 27 contractor.

2.4 CABLE MANAGEMENT & LADDER RACK

A. General

1. Where Electronic Security System equipment is co-located in a Communications Room, cable management and ladder rack shall be by Division 27 “Structured Cabling System” contractor, unless otherwise noted.

2.5 GROUNDING AND BONDING REQUIREMENTS

A. General Requirements

1. Where Electronic Security System equipment is co-located in a Communications Room:
    a. Grounding/Bonding bar (TGB) and connection to Electrical System ground shall be by Division 27 “Structured Cabling System” contractor.
    b. Electronic Security Contractor shall provide all ground wire and final connections from Division 28 Electronic Security System equipment to TGB. Coordinate with Division 27 Structured Cabling System contractor.
2. Conditionally-approved manufacturers:
    a. Chatsworth
    b. Cooper B-Line
    c. Erico
    d. Harger
    e. Hoffman
    f. Panduit

B. Connectors

1. Specifications
    a. All connections between cables and the joining or mating of cables to connectors shall be done by exothermic weld or irreversible compression connector.
    b. Connector Terminal: Heavy duty, high copper alloy terminal for joining cable to grounding bus bar.
    c. Twin clamping elements for cable; two holes for attachment to grounding bar, etc
2. Manufacturer shall be

a. Burndy type KK###-2N series

b. Panduit type LCC series

c. Cadweld type GL (B-122 series)

d. Cadweld type LR

e. Or equivalent from Conditionally-approved manufacturer listed above

C. Connector Terminals

1. Specifications

a. Medium duty, high copper alloy terminal for joining cable to equipment racks, cable racking and cable tray.

b. Twin clamping elements for cable; one (or more) holes for attachment to rack, tray, etc.

2. Manufacturer shall be

a. Burndy type QQA series or VVA series

b. Or equivalent from Panduit

c. Or equivalent from Cadweld

d. Or equivalent from Conditionally-approved manufacturer listed above

D. Bonding Conductors

1. Specifications

a. All grounding and bonding connectors shall be listed by a Nationally Recognized Testing Laboratory (NRTL) as required by the NEC, such as UL.

b. All grounding and bonding conductors shall be stranded copper.

c. When routed through plenum or other air-handling space, provide Non-Insulated grounding wire

d. When not routed through plenum or other air-handling space, provide Insulated grounding wire

1) When conductors are insulated, they shall be listed for the application (i.e. Plenum, riser, outside plant, etc.)

e. Cable jacket marking: Shall be legible and shall contain the following information:

1) Manufacturer's name.

2) Copper Conductor Gauge.

3) UL listing.

f. Cable jacket shall be green with black lettering.

g. Conductor material: Annealed (soft) copper complying with ICEA S-95-658/NEMA WC70 and UL Standards 44 or 83, as applicable; stranded conductor.

h. The minimum size shall be a #6 AWG.

i. The size shall be 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil, following this table:

TABLE 2: BONDING CONDUCTOR SIZING TABLE

Length (ft)	Size (AWG)
Less than 13'	#6

14’-20’	#4
21’-26’	#3
27’-33’	#2
34’-41’	#1
42’-52’	#1/0
53’-66’	#2/0
67’-84’	#3/0
85’-105’	#4/0
106’-125’	250 kcmil
126’-150’	300 kcmil
151’-175’	350 kcmil
176’-250’	500 kcmil
251’-300’	600 kcmil
Greater than 300’	750 kcmil

2. Manufacturer shall be:

   a. From the list of Conditionally-approved Manufacturers above; or

   b. From the list of manufacturers in Division 26 section “Low-Voltage Electrical Power Conductors and Cables”.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to start-up of Electronic Security System, check all electrical circuits that will serve Electronic Security Equipment to ensure correct wiring polarity and ground impedance is less than 5.0 ohm (per IEEE 1100). Notify Design Consultant of any issues in a timely manner and await correction prior to use of effected circuits.

B. Labeling requirements

1. Equipment Racks, Cabinets, and Enclosures are to be labeled at the top of both the front and back sides, minimum text height shall be 3/8”.

   a. Submit proposed labeling scheme on Shop Drawings for review and approval by Design Consultant and Owner.

      1) For multiple racks/cabinets in a single equipment room, racks are to be numbered left to right, from front of room to back.

      2) For projects with more than one Equipment Room, labeling scheme shall first indicate Equipment Room number/designator.

2. Wall-mounted Entrance Protectors shall be labeled with device/location it is protecting. Example – “Camera #54 on SW corner of building”.

3. Grounding and Bonding conductors that leave the room shall be labeled with size, far-end destination, and total length. Example - #1/0 to Panelboard A2, 50’

C. Quantities and sizes of equipment room fittings shown on the Drawings are illustrative only and are meant to indicate the general configuration of the work. Provide the correct quantities of all materials necessary to accommodate the work described in these specifications and schedules and shown on the Drawings.

3.2 PLYWOOD BACKBOARDS

A. Install plywood backboard in Equipment Rooms such that bottom is 12” AFF with smooth side facing the room interior.

B. If plywood isn’t fire-retardant, mask out a stamp on the front of the plywood and paint plywood with two coats of white, fire-retardant paint. Remove masking material so stamp is visible.

3.3 ENTRANCE PROTECTION

A. Fully protect each end of all incoming conductors which are considered to have lightning exposure in accordance with NEC chapter 8.

B. Install grounding/bonding wire as straight as possible from protector to TGB.

C. Grounding and bonding

1. Bond all metallic shields and armored jacketing material for all incoming cables as close as practicable to the entry into the building.
2. Bonding conductors shall be connected to the TGB as specified in this Section and in accordance with NEC chapter 8.

3.4 CABINETS, RACKS, AND ENCLOSURES

A. Wall cabinets and enclosures shall be installed on a plywood backboard or attached to a masonry wall. The rack should not be attached to sheet rock (gypsum wall board).

B. Tags/labels shall be placed on each equipment rack, cabinet and frame in accordance with Part 3 – General instructions of this section.

3.5 CABLE MANAGEMENT

A. Horizontal and Vertical Cable Managers

1. Install cable organizers and/or cable channel on equipment racks and within cabinets at locations as described in the Specifications and/or indicated on the Drawings.

3.6 GROUNDING/BONDING REQUIREMENTS

A. General:

1. Installation shall follow ANSI/NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings.
2. Install the grounding and bonding conductors (wire) without splices or mechanical couplers installed between the wire points of origin and termination.
3. Where insulated conductors are necessary provide adequately rated insulation jackets or pathways to meet all required building codes. (I.e. Plenum, riser, outside plant, run entirely in conduit, etc.)
4. Grounding and bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place grounding and bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit using a grounding bushing and a No. 6 AWG conductor, minimum.

B. Required Connections:

1. Provide and install all bonding/grounding connections as required by Grounding Diagram Detail(s) on the drawings, and as required by equipment manufacturers, applicable codes, and the referenced standards.
2. Provide and install one individual ground wire from each equipment rack/cabinet/frame and wall-mounted enclosure to the TGB in the room. Each conductor is to be “home run”; do not “daisy chain” the connections, except as may be indicated on the drawings.
3. Provide and install one individual ground wire from the overhead ladder racking (installed under this work) to the TGB in the room
4. Install one individual ground wire from each TGB to one of the following:
    a. Properly-bonding building steel (if available)
    b. The serving electrical panel ground bus.

C. Connector Installation:

1. Provide all ground wire connectors as shown on the Drawings or as indicated herein, unless otherwise noted.
2. Follow the connector manufacturer’s instructions for installing the connector to the cable and the connector to the cabinet/rack, ground bar, etc. Use the appropriate tools for the job, tighten nuts/bolts to proper torque, remove paint, insulation, oxidation as needed to assure good metal to metal contact, etc. If the manufacturer does not provide tightening specifications, follow the recommendations of UL Standard 486.

D. Cable Identification:

1. Label individual bonding and grounding conductors in accordance with Part 3 – General instructions of this section.
2. Additional, provide a label above each TGB that states the following: IF CONNECTORS OR CABLES ARE LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING SECURITY MANAGER.

E. Quantities of Ground Wire / Bonding Conductors

1. Location and placement of grounding and bonding wires/conductors and components shall be as shown on the Drawings or defined herein.
2. Quantities of ground/bond wires/conductors, bonding components, etc. shown on the drawings are illustrative only and are meant to indicate the general configuration of the work. Provide the correct quantities of materials to construct a complete grounding and bonding system that meets the intent of these Specifications, the relevant codes, and referenced standards.

F. Testing

1. As a minimum test, as described below, all metallic bonding conductors installed under these Specifications.
2. Test the conductor and the terminal connectors for total resistance between the equipment item being grounded and the TGB in the room. This resistance shall be less than 0.10 Ohm (100 milliohms).
3. Recommended test equipment:
    a. An ohmmeter capable of indicating resistance down to 10 milli-ohms or below.
    b. Earth Ground Resistance Tester that is configured for continuity test (two-point test)

G. Record Drawings

1. The Project Record Drawings shall show the types and locations of installed grounding and bonding conductors.

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SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Work Included: All labor, materials, appliances, tools, equipment necessary for and incidental to performing all operations in connection with furnishing, delivery and installation of the work of this Section, complete, as shown on the drawings and/or specified herein. Work includes, but is not necessarily limited to the following:

1. Examine all other specifications sections and drawings for related work required to be included as work under Division 26 00 00, 27 00 00, 28 00 00.

2. General provisions and requirements for electrical work.

B. The scope of work is limited to the installation, testing and commissioning and complete handover of new fire alarm devices within the new classroom building. The installation shall be connected and integrated with the existing school campus system

C. Include for all new wiring, underground connections to the existing system, testing, commissioning and final handover. All devices shall operate seamlessly with the existing campus system.

1.2 SUBMITTALS (ADDITIONAL REQUIREMENTS)

A. Submit eight (8) copies of the following to the Architect for approval.

1. A listing of all fire alarm components and equipment including the California State Fire Marshal (CSFM) listing numbers.

2. CSFM listing sheets of all devices being used.

3. Manufacturers' standard catalog data for fire alarm components.

a. The submittal shall be arranged in the order of the Specification and shall list the specification paragraph number, the name, the proposed model and manufacturer for each item as well as a reference indicating the specific piece of data which can be easily located in the brochure.

b. The manufacturers' data sheets shall be marked to indicate the specific item being proposed in cases where the sheet covers several types or sizes of item. The data sheet shall completely describe the proposed item.

c. Where modification to the equipment is necessary to meet the operational requirements of the contract documents, the data sheets shall include complete mechanical and electrical shop drawings detailing the modification.

4. A listing of the outlet rough-in needed for every device and equipment item. The applicable symbol which illustrates that rough-in item on the job plans shall be drawn on the proposal, opposite the description of the rough-in to facilitate locating the data by field personnel.

5. Elevation and dimensional information.

1.3 APPLICABLE STANDARDS

1. List of applicable codes:

a) 2007 Building Standards Administrative Code, Part 1, Title 24 C.C.R.

b) 2016 California Building Code (CBC), Part 2, Title 24 C.C.R. (2006 International Building Code Volumes 1-3 and 2008 California Amendments).

c) 2016 California Electrical Code (CEC), Part 3, Title 24 C.C.R. (2008 National Electrical Code and 2007 California Amendments)

d) 2016 California Mechanical Code (CMC), Part 4, Title 24 C.C.R. (2008 Uniform Mechanical Code and 2008 California Amendments).

e) 2016 California Plumbing Code (CPC), Part 5, Title 24 C.C.R. (2008 Uniform Plumbing code and 2008 California Amendments)

f) 2016 California Fire Code (CFC), Part 9, Title 24, C.C.R. (2008 International Fire Code and 2008 California Amendments).

g) 2016 California Referenced Standards Code, Part 12, Title 24, C.C.R.

h) Title 19, C.C.R., Public Safety, State Fire Marshal Regulations.

i) 2016 California Energy Code (CEC, Part 6, Title 24 C.C.R.

2. NFPA Standards and Guides:

a) NFPA 13, Automatic Sprinkler Systems, 2013 Edition.

b) NFPA 24, Private Fire Mains, 2013 Edition.

c) NFPA 72, National Fire Alarm Code, (California Amended) 2013 Edition. (Note see UL standard 1971 for "visual devices")

3. The fire alarm system shall conform to CBC Sec. 809, CFC Article 14, Article 760 of California Electrical code, NFPA 72, and the applicable Standards and Guides referenced in CBC Chapter 60.

B. Written certification by the fire alarm equipment manufacturer shall be submitted to the Architect, stating that the system and its component parts are listed and approved by the California State Fire Marshal and the installation has been tested, is operational and conforms to the requirements as set forth in Part 3, Article 24, Title 19, California Code of Regulations.

1.4 EQUIPMENT AND INSTALLING QUALIFICATIONS

A. The equipment shall be manufactured by Notifier to match existing installation on the school campus.

B. All equipment shall conform to all local applicable codes and ordinances, and shall be listed by Underwriters Laboratories.

C. To qualify as an acceptable bidder, whether the bid is submitted to the District, his agent, a general contractor or a sub-contractor, the system bidder or contractor shall be qualified fire alarm contractor and shall hold a valid C10 License issued by the Contractors State License Board of California. The system bidder or Contractor shall hereinafter be referred to as the

Contractor. The Contractor shall hold all other licenses required by the legally constituted authorities having jurisdiction over the work. The Contractor shall be the factory authorized distributor for the branch of equipment offered and shall have been engaged in the business of supplying and installing the specified type of system for at least five years. The Contractor shall maintain a fully equipped service organization capable of furnishing adequate repair service to the equipment. The Contractor shall be financially able to provide a performance bond covering the work and the guarantee described. The Contractor shall provide that bond if requested.

D. Installation Certification

1. Work and material for cables, cable terminations and related components shall be performed by certified installers. The installer shall be certified by the respective product manufacturers.

2. The manufacturers of the indicated work and material, shall provide a installer education/training and certification program for the supplied products.

3. The installers performing the Contract work for the indicated products, shall have attended and successfully completed each of the respective manufacturer's installation training education programs for the specified products.

4. Submit six (6) copies of the manufacturer's certifications for each installer performing the work. The submittal shall be approved prior to initiating any related contract work.

5. Contract material installed and work performed by installers not complying with these requirements shall be removed. Removal of work and material not in compliance with these requirements shall done at the CONTRACTOR'S expense, without any additional cost to the contract and without any additional contract completion due date extensions. New material and work required to replace the non-compiling removed work and material shall be provided at the CONTRACTOR'S expense, without any additional cost to the contract and without any additional contract completion due date extensions.

6. Certifications: Submit certification from the equipment manufacturer indicating the installer is an authorized representative of the equipment manufacturer in the area the new system is to be installed in and is trained on network applications.

7. Electrical Materials and equipment installed shall be new.

8. All of the equipment in this specification shall be furnished and installed by the Authorized Factory Distributor of the equipment. The Contractor shall furnish a letter from the manufacturer of al major equipment, which certifies that the installing Contractor is the Authorized Distributor and that the equipment has been installed according to factory intended practices. The Contractor shall also furnish a written guarantee from the manufacturer that they will have a service representative assigned to this area for the life of the equipment.

1.5 WARRANTY

A. Manufacturer shall provide a 5 year material warranty. Installer shall provide a 3 year labor warranty.

B. Complete maintenance and repair service for a fire alarm system shall be available from a factory trained authorized representative of the manufacturer for a period of 5 years after expiration of the warranty.

PART 2 - PRODUCTS

2.1 GENERAL SYSTEM OPERATION

A. System shall be microprocessor-based, addressable, and power-limited with Class B supervised circuits.

1. The microprocessor shall execute all supervisory and control programming to detect, report the failure or disconnection of any system module or peripheral device and initiate programmed control sequences. An isolated supervision "watchdog" circuit shall monitor the microprocessor and, upon failure, shall activate the system trouble circuits.

2. The automatic fire detection and alarm system shall consist of sub-main control panel, transponder panel(s), notification alarm devices, remote annunciator, automatic detection devices, manual stations, printer, and CRT/keyboard, installed and wired in accordance with the drawings and shall function as specified herein.

3. The system shall be programmable in the field, by a non-computer trained person. All programmed information shall be stored in non-volatile memory.

4. The system shall operate both addressable and non-addressable ionization, thermal and photoelectric detecting devices, manual stations, water-flow switches, and external control modules.

5. The control panel shall provide power, annunciation, supervision and control for the fire detection and alarm system. The system shall be designed such that alarm indications override trouble and control conditions.

6. External circuit supervision shall not require additional wires other than the pair used for detection or alarm (only two wires shall be used from the control panel to each loop of initiating devices and two wires for the notification alarm devices). These two wires shall provide both supervision and notification alarm signals. There shall be no loss of supervision for Class "B" wired addressable devices. Class "A" supervision may be provided by adding an additional pair of wires.

B. Alarm Conditions

1. Actuation of any manual or automatic alarm initiating device, connected to the system shall cause the following automatic functions.

a) All notification alarm signaling units shall activate continuously. Audible notification alarms shall sound the California State coded signal.

b) The respective zone alarm lamp or annunciator alpha numeric readout on the central control panel shall be activated.

2. Actuation of HV/AC air duct smoke detectors shall stop the designated fans and motors in the building's air distribution system.

3. Notification alarm signal duration shall be capable of continuous sounding or adjustable from three to ten minutes.

4. Perform any additional functions as specified herein or shown on the drawings.

C. Trouble Condition

1. A single open or single trouble condition in a manual or automatic fire initiating wiring circuit shall activate the respective zone trouble lamp or annunciator readout on the fire alarm control panel and sound a trouble signal at the control panel.

2. A single open or single trouble condition in the notification alarm signaling wiring circuit shall activate the trouble lamp or annunciator readout in the control panel and sound a trouble signal at the control panel.

3. 120 volt AC normal power shall be monitored with indication by a "power on" lamp. Upon normal power outage, the system shall activate a power trouble condition lamp or annunciator readout, and indicate a trouble condition.

4. The control panel shall monitor the standby batteries and, upon a low battery condition, activate the low battery lamp or annunciator readout and indicate a trouble condition.

5. System ground detection shall be provided for the entire system. Upon ground detection, activate the ground detection lamp or annunciator readout and indicate a trouble condition.

D. Control panels employing alpha numeric readouts shall display the trouble condition along with a prompt to review the list chronologically. The end of the list shall be indicated.

2.2 MANUALLY ACTIVATED ALARM INITIATING DEVICES

A. An electronic, digital multiplex, addressable module shall be incorporated into each device. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.

B. Devices shall be suitable for use on a class "B", 2-wire supervised alarm initiating circuit.

C. Numbered screw type terminals shall be provided for "in-out" connections of the alarm circuit wiring.

D. The face of the station shall have lettering indicating "FIRE" and operational instructions. Stations shall be tamper resistant, semi-flush mounting.

E. Auxiliary spare switch contact shall be provided for control of remote devices rated 120 volts - 60HZ, AC - 3AMP minimum.

F. Stations shall provide visual indication the station has been activated. A key (and/or special tool) shall be required to gain access into the station to reset the station after being activated.

G. Stations shall be "nonbreak-glass" type.

H. RF and transient filtering shall be provided in the device electronics.

I. Pull stations shall be non-coded double action, requiring two distinct manual "pulling" actions to initiate the fire alarm system.

J. Stations installed outdoors shall be weather resistant construction, double action to activate the pull station.

2.3 AUTOMATIC ALARM INITIATING DEVICES

A. General

1. An electronic digital, multiplex, addressable module shall be incorporated into each device. The module shall communicate the status and trouble condition of each device with a unique address code. The module shall communicate with and be supervised and monitored by the fire alarm control panel.

2. Devices shall be suitable for use on a Class "B", 2-wire supervised alarm initiating circuit. Where initiating devices are shown connected to an existing system, devices shall operated on two or four wire circuits plus - 2 - wire power circuit as required by the existing equipment.

3. Numbered screw type terminals shall be provided for "in-out" connectors of the alarm circuit wiring.

4. Auxiliary double throw spare relay contact shall be provided for activation of remote rated devices 120V-60Hz, AC - 1 Ampere minimum.

5. RF and transient filtering shall be provided in the initiating device electronics.

6. Initiating devices shall be reset from the control panel and shall not require individual resetting.

B. Smoke Detector Shall be 4098-9714

1. Detectors shall comply with UL standard 268, 167 and 168, and shall use solid state electronic circuits throughout.

2. The smoke detector shall operate on a total of two circuit wires. Alarm signaling and detector power shall use the same conductors. Detector sensitivity shall be factory set at 1.5%.

3. A fine mesh insect screen shall be provided on all detector openings.

4. The detector shall lock-in on alarm and shall provide a visual alarm/trouble indicator light. An electromechanical test feature shall provide functional testing of the unit without smoke.

5. The detector shall also incorporate a fixed temperature heat detector rated at 135 degrees F. The heat detector shall operate the alarm circuit and alarm/trouble light.

   a) Photo electric type smoke detectors shall employ a light emitting diode (LED) as the detector light source, activated by the presence of combustion smoke products. Failure of the LED shall activate the alarm/trouble light on the detector.

   b) Ionization type smoke detector shall employ the triple chamber (dual chamber) ionization principle, activated by the presence of combustion products. The ionization chamber shall be RF shielded.

   c) Air duct smoke detector photo electric or ionization type for installation on a mechanical air ducts. Two air tubes shall extend into the air duct. The sampling tube shall extend across the entire width of the air duct. The second tube shall allow air to escape back into the duct.

C. Fire Detector – Heat Shall be 4098-9733

1. Heat detectors shall be dual action electro-thermostatic combination rate of temperature rise and fixed temperature operation. A indicator shall be visible when detector has activated.

2. The rate of rise element shall be self restoring, after activation.

3. The fixed temperature unit shall be set at 136 degrees F (190 degrees F for high temperature areas i.e. over 110 degrees F.)

D. Fire Sprinkler Water Flow Detector.

1. Vane-type water flow detectors shall be provided on the sprinkler system piping as shown on the drawings. Detectors shall be designed for mounting on either vertical or horizontal piping, but shall not be mounted in a fitting or within 12 inches of any fitting that changes the direction of water flow.

2. The detectors shall have a sensitivity setting to signal any flow of water that equals or exceeds the discharge from one sprinkler head.

3. Detector switch mechanisms shall incorporate an instantly recycling pneumatic retard element with an adjustable range of 0 to 70 seconds. Switches shall have a minimum rated capacity of 7 amp 125 volt A.C. - .25 amp 24 volt D.C. A D.P.D.T. switch shall be actuated by a polyethylene vane extending into the waterway of the piping.

4. Detectors shall be of weatherproof, dust tight construction and shall provide a 3/4 inch conduit entrance. Detector shall be finished in red baked enamel.

5. Flow switch shall be sized to match the fire sprinkler riser pipe diameter.

E. Fire Sprinkler Valve Tamper Switch

1. Tamper switch shall monitor the position of the fire sprinkler shut-off valve. Operation of the valve shall activate the switch and activate a trouble alarm.

2.4 NOTIFICATION ALARM DEVICES

A. General

1. Notification alarm devices shall activate automatically from the control panel. Devices shall operate on a Class "B" (Style Y), 2-wire supervised alarm notification circuit. Series wired alarm devices shall not be used.

2. Numbered screw type terminals shall be provided for "in-out" connections of the alarm circuit wiring.

3. Devices shall be installed in a box, 3 1/2" deep maximum, flush mounting unless indicated otherwise on the drawings. Size as required for the alarm indicating device and wiring connections. Provide a trim ring and metal grill cover assembly. Cover assembly shall be minimum of 1/16" minimum thick flat stainless steel or aluminum. Finish color as selected by Architect. The word "fire" shall appear on the grill minimum 1/2" letters. The grill shall be attached with screws to the box.

4. Each audible notification visual devices shall incorporate a visual alarm indicator. The visual alarm indicating device shall be an integral part of the audible alarm box assembly.

5. Audible notification device and visual notification devices shall be connected to separate notification alarm signal circuits. Do not connect these devices to the same circuit conductors.

B. Audible Alarm speakers Shall be 4906-9127

1. Speakers installed indoors shall be electronic type.

2. Speakers shall provide a minimum sound level of 75 DB at 10 feet, when installed in the field operating conditions shown on the drawings.

3. Outdoor speakers shall be electro-mechanical, weatherproof and shall be mounted in a recessed backbox with vandal resistant grille, Soundolier 193-8/VP-161 series.

4. Audible devices shall provide a minimum sound level of 10DB over the ambient level measured 48" above the floor.

C. Visual Alarm Indicator Shall be 4906-9101

1. Lamp/Strobe internally illuminated projecting lens assembly, with flasher system. Unit shall flash on and off to provide visual indicating of fire alarm.

2. The word "fire" shall appear on the lens or lens plate.

3. Flash rate, one flash per second, with a flash duration of approximately 0.001 second, flash rate independent of audible device.

4. Light source, Xenon high intensity flash strobe tube white/clear color.

5. Strobe shall have a minimum output of 75 candela with a maximum flash intensity of 120 candela.

6. Strobe shall comply with NFPA requirements.

PART 3 - EXECUTION

3.1 IDENTIFICATION (ADDITIONAL REQUIREMENTS)

A. The inside cover of alarm initiating devices shall be marked with the zone initiating number corresponding to the zone number in the control panel. Marking shall be with a felt-tip pen.

B. Each fire alarm terminal cabinet shall be painted red.

C. Provide nameplate: "Power to Fire Alarm Control Panel" screwed onto the branch circuit overcurrent device supplying power to the main fire alarm control panel.

3.2 WIRING (ADDITIONAL REQUIREMENTS)

A. Review the total system point-to-point wiring layout to assure that the correct number and type of wires and conduit sizes are installed.

B. Final connections, testing, adjusting and calibration shall be made under the direct supervision of a factory-trained technician of the system supplier.

C. All wiring shall be in conduit.

D. All wiring in cabinets shall be neatly formed, laced and made up on bolt and nut terminal blocks. Tag all spare conductors. All conductors shall terminate on terminal strips with spade lugs, of adequate size for all incoming and outgoing conductors. The strips shall be labeled as to their use and wiring diagram shall be placed on the cabinet door showing connections of all related equipment to these strips.

E. Wiring requirements for shielding certain conductors shall be as recommended by the manufacturer. Provide all conduit, raceways and conductors per manufacturers recommendations and include all material and labor costs in the contract price.

F. The conductors used for digital, multiplex communication between the fire alarm control panel and external remote initiation devices, control points and annunciators, shall be twisted, shielded, multi-conductor cable, #16 AWG copper minimum with a separate internal ground/drain conductor, UL listed for fire alarm system use. One spare pair of multiplex conductors shall be provided in all main and branch device/equipment connections for future system use. "Tees" and taps at any junction box location in the communication lines, shall be permitted by the system to additional devices without affecting proper system operation.

G. Wire Size: Wire shall be sized to insure installed circuit voltage drop does not exceed 10% to all devices.

H. In terminal cabinets, installer shall provide a wire index identifying the building and locations of devices.

I. All underground wiring shall be Aquaseal suitable for outdoor use, or approved equal.

3.3 OUTLET BOXES (ADDITIONAL REQUIREMENTS)

A. Device outlet boxes shall be flush mounted unless indicated otherwise on the drawings. Provide extension rings to finish flush with finish surface. Where the drawings indicate surface mounted devices, outlet boxes shall be cast metal with threaded hubs. Where the conduit entrances are not exposed for surface mounted devices, provide flush outlet box behind the device box and omit the conduit hubs on the device box. Size device boxes and outlet boxes per manufacturers recommendation and as required by code for wire fill.

3.4 SPECIAL INSTALLATION REQUIREMENTS

A. Air duct smoke detectors shall be installed in the supply air ducts and return air ducts with an air flow of 2000 CFM or greater, coordinate with mechanical contractor. Sampling tube shall extend across entire duct width. Provide 3/4" conduit with 2#12 to respective motor control device to automatically shut down the respective fan motor upon detection of smoke in the air duct.

B. Water flow switches shall be installed on each main fire sprinkler rise pipe, coordinate with the fire sprinkler contractor.

C. Tamper switches shall be installed on each main fire sprinkler shut-off valve, coordinate with the fire sprinkler contractor.

D. Equipment shall be weatherproof gasketed where installed in locations exterior to the building, or where indicated on the drawings. Weatherproof equipment shall be tamper resistant.

E. Connect fire alarm control panel with main campus FACP.

F. Connect fire alarm control panel with master clock system to turn off class passing schedule, with paging system to turn off system when fire alarm system in alarm condition.

G. Conduit with fire alarm wiring shall be painted red.

H. Fire alarm system shall be programmed per actual building and room designation. Submit printout for review.

I. Contractor shall thoroughly clean all work areas where work was performed at the end of each day. All areas shall be ready for the school to occupy and conduct classes/school the next working day.

J. Contractor shall cover all contents of the rooms in which work is being performed with suitable plastic sheeting prior to the commencement of work.

K. In occupied campuses, Contractor shall provide for safe access for all students and staff.

3.5 TESTING

A. The entire fire alarm system shall be tested in the presence of the local DSA Inspector and a representative of the manufacturer after the installation is complete.

1. Individually activate each manual initiating station and verify correct alarm operation and control panel response.

2. Individually test each automatic initiating device and verify correct alarm operation, control panel response and remote equipment operation.

3. The communication loops and the notification alarm circuits shall be opened in at least two (2) locations per building to check for the presence of correct supervisory circuitry.

B. Test the battery back-up system by disconnecting the incoming normal power and allowing this alarm system to operate 24 hours on battery power. Sound the alarm system for five minutes at the end of 24 hours on battery power.

C. Perform all electrical and mechanical tests required by the equipment manufacturer's certification form. Measure and adjust each automatic detection detector to the maximum stable sensitivity setting. Detector tests shall be performed with the detector at its operational location and under normal operational environmental conditions in the area. Bench settings are not acceptable. An operational check-out test and report shall be performed. Submit six copies of test report results. The tests and report shall include, but not be limited to:

1. A complete list of equipment installed and wired.

2. Indication that all equipment is properly installed and functions and conforms with these specifications.

3. Test of individual zones as applicable.

4. Serial numbers, locations by zone and model number for each installed detector.

5. Voltage (sensitivity) settings for each ionization and photoelectric detector as measured in place with the HVAC system operating.

6. Technician's name, certificate number and date.

7. The completed manual and automatic monitoring and control system shall be tested to insure that it is operating properly. This test will consist of exposing the installed units to a standard fire test.

8. Acceptance of the system shall also require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day test period without any unwarranted alarms. Should an unwarranted alarm(s) occur, the contractor shall readjust or replace the equipment and detector(s) and begin another ninety (90) day test period. As required by the Architect, the contractor shall recheck the detectors using the fire test after each readjustment or replacement of detectors. This test shall not start until the District has obtained beneficial use of the building under tests.

D. After the testing has been completed to the satisfaction of the inspectors, provide the NFPA certificate of compliance to the District, the local Fire Official, the Architect and DSA.

E. Upon the receipt of Certificate of Compliance, the installer/supplier shall supply the Owner with a written operating, testing and maintenance instructions, point-to-point as-built drawings, and equipment specifications.

F. Provide a two (2) hour instructional sessions conducted by a factory-authorized technician at the job site after completion of all tests to instruct School District personnel on the use of the system. The first session shall be videotaped and conducted prior to final acceptance of the project. The second session shall be held within eleven months of final acceptance of the project, when requested by the District.

G. Installer shall protect all work until the Fire Alarm System has been accepted by the Inspector.

3.6. OPERATING/SERVICE MANUALS

A. Submit 5 copies of service all manuals and all current programming software including the following:

1. Detailed explanation of the operation of the system.

2. Instructions for routine maintenance.

3. Detailed instruction for repair of major components of the system.

4. Pictoral parts list and art numbers.

5. Pictoral and schematic electrical drawings of wiring systems, including operating and safety control panels, annunciators and major components.

6. Installation instructions for system components.

7. Programming instructions and programming disk(s).

8. Programming listing.

9. Final test report.

10. A single reproducible set of record drawings reflecting the system exactly as it was installed including exact locations of components.

END OF SECTION

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SECTION 28 33 00

INTRUSION DETECTION

PART 1 - GENERAL REQUIREMENTS

1.1 SUMMARY

A. Expand the existing DSC Maxsys Intrusion Detection System to provide a complete functioning system, and each element thereof, as specified, indicated, or reasonably inferred, on the Drawings and in these Specifications, including every article, device, or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, supplies, tools, equipment, transportation and utilities.

B. The general scope includes, but is not limited to, these main systems:

1. Duress alarms, with communication links to perform monitoring, alarm, and control functions.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Work under this section shall follow Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems".

C. Work under this section shall follow Division 28 Section "Common Work Results for Electronic Security Systems" for general pathway, firestopping, access panel, identification, and other requirements.

D. Other related documents include:

1. Division 28 Section "Conductors and Cables for Electronic Safety and Security".
2. Division 28 Section "Telecommunications Requirements for Electronic Security".
3. Division 28 Section "Equipment Room Fittings for Electronic Security".

1.3 CODES AN STANDARDS

A. In addition to the Codes and Standards listed in Division 28 Sections "General Electronic Safety and Security Requirements" and "Electronic Security Systems", products and installation shall meet the requirements of the following standards:

1. ANSI/SIA CP-01-2010 – Control Panel Standard
2. UL 603 – Power Supplies for Use with Burglar-Alarm Systems
3. UL 609 – Local Burglar Alarm
4. UL 639 – Intrusion-Detection Units
5. UL 1610 – Central-Station Burglar Alarm Units

1.4 ABBREVIATIONS AND DEFINITIONS

A. In addition to the Abbreviations and Definitions listed in Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”, additional terms that may be utilized in the Construction Documents include:

1. PIR: Passive infrared
2. RFI: Radio-frequency interference
3. Control Unit: System component that monitors inputs and controls outputs through various circuits.
4. Master Control Unit: System component that accepts inputs from other control units and may also perform control-unit functions. The unit has limited capacity for the number of protected zones and is installed at an unattended location or at a location where it is not the attendant's primary function to monitor the security system.
5. Monitoring Station: Facility that receives signals and has personnel in attendance at all times to respond to signals. A central station is a monitoring station that is listed.
6. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.
7. Standard Intruder: A person who weighs at least 100 lb and whose height is at least 48”; dressed in a long-sleeved shirt, slacks, and shoes.
8. Standard-Intruder Movement: Any movement, such as walking, running, crawling, rolling, or jumping, of a "standard intruder" in a protected zone.
9. Systems Integration: The bringing together of components of several systems containing interacting components to achieve indicated functional operation of combined systems.
10. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.5 QUALITY ASSURANCE

A. Contractor qualifications:

1. The ESC, or a qualified Intrusion Detection Contractor acting as a sub-contractor to the ESC, shall have a minimum five (5) continuous years in the business of installing and integrating Intrusion Detection Systems.
2. ESC or qualified sub-contractor shall be a certified installer by the intrusion detection equipment manufacturers whose products shall be incorporated into this project. Post-award certification will not be accepted.
3. ESC or qualified sub-contractor shall maintain certification by the manufacturers thru the duration of the warrantee period.

B. Personnel qualifications

1. All equipment/device installation and programming shall be conducted by factory-certified technicians of the components being installed.

C. Warranty

1. At a minimum, the manufacturer(s) equipment shall be covered by a 1-year parts and labor warranty covered by the ESC starting from Substantial Completion.
2. Refer to Division 28 Section “Electronic Security Systems” for warranty and service call requirements.

a. All Warranty Work shall be completed by factory-certified technician(s) of the component(s) being address.

1.6 COORDINATION

A. Coordinate with Division 8 Door Hardware prior to installing Intrusion Detection field devices within doors and door frames.

1.7 SUBMITTALS

A. Refer to requirements in Division 28 Sections “General Electronic Safety and Security Requirements” and “Electronic Security Systems”.

PART 2 - PRODUCTS

2.1 FUNCTIONAL DESCRIPTION OF SYSTEM

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Review Construction Drawings for information related to the functional description of the system.

C. Supervision: System components shall be continuously monitored for normal, alarm, supervisory, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.

1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.
3. Supervisory Condition Signal: Distinct from other signals, indicating an abnormal condition as specified for the particular device or control unit.

D. System Control: Master control unit shall directly monitor intrusion detection units and connecting wiring.

E. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

F. Operator Commands:

1. Help with System Operation: Display all commands available to operator. Help command, followed by a specific command, shall produce a short explanation of the purpose, use, and system reaction to that command.
2. Acknowledge Alarm: To indicate that alarm message has been observed by operator.
3. Place Protected Zone in Access: Disable all intrusion-alarm circuits of a specific protected zone. Tamper circuits may not be disabled by operator.
4. Place Protected Zone in Secure: Activate all intrusion-alarm circuits of a protected zone.
5. Protected Zone Test: Initiate operational test of a specific protected zone.
6. System Test: Initiate system-wide operational test.

G. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

H. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

I. Programmed Secure-Access Control: System shall be programmable to automatically change status of various combinations of protected zones between secure and access conditions at scheduled times. Status changes may be preset for repetitive, daily, and weekly; specially scheduled operations may be preset up to a year in advance. Manual secure-access control stations shall override programmed settings.

J. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.2 SYSTEM COMPONENT REQUIREMENTS

A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:

1. Door hardware specified in Division 08 Section "Door Hardware."
2. Door hardware specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.

1. Minimum Protection for Power Lines 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."
2. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

E. Tamper Protection: Tamper switches on detection devices, control units, annunciators, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled and when entering conductors are cut or disconnected. Master control-unit alarm display shall identify tamper alarms and indicate locations.

F. Self-Testing Devices: Automatically test themselves periodically, but not less than once per hour, to verify normal device functioning and alarm initiation capability. Devices transmit test failure to master control unit.

G. Antimasking Devices: Automatically check operation continuously or at intervals of a minute or less, and use signal-processing logic to detect blocking, masking, jamming, tampering, or other operational dysfunction. Devices transmit detection of operational dysfunction to master control unit as an alarm signal.

H. Addressable Devices: Transmitter and receivers shall communicate unique device identification and status reports to master control unit.

I. [Remote-Controlled Devices: Individually and remotely adjustable for sensitivity and individually monitored at master control unit for calibration, sensitivity, and alarm condition.]

2.3 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Exterior Electronics: NEMA 250, Type 4X, stainless steel.

D. Corrosion Resistant: NEMA 250, Type 4X, stainless steel.

E. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.4 DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. DSC by Tyco Security Products

B. Keypad and Display Module: Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data

1. Provide a Keypad compatible with the Intrusion Detection Control Panel.
2. Shall have a minimum of a 2 line by 16 character backlit LCD.
3. Shall have a minimum of 16 keys on the key pad.

C. MICROWAVE-PIR DUAL-TECHNOLOGY SENSORS

1. Basis-of-Design Product: Subject to compliance with requirements, provide DSC or comparable product by one of the following:
   a. Honeywell International Inc.; Honeywell Security
   b. GE Security, Inc.
   c. Bosch Security Systems
2. Description: Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.
3. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.
4. Device Performance: An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

D. DOOR MONITORING CONTACTS - RECESSED

1. Basis-of-Design Product: Subject to compliance with requirements, provide Interlogix 1076 Series or comparable product by one of the following:
   a. Bosch Security Systems
   b. Honeywell International Inc.; Honeywell Security.
2. Description: Recessed SPDT switch shall monitor door position. Switch color to match door and door frame.

E. DOOR MONITORING CONTACTS – SURFACE MOUNT

1. Basis-of-Design Product: Subject to compliance with requirements, provide Interlogix 2700 Series or comparable product by one of the following:

   a. Bosch Security Systems

   b. Honeywell International Inc.; Honeywell Security

2. Description: Surface-mount SPDT switch with minimum 18-inch armored cable shall monitor door position.

F. DOOR MONITORING CONTACTS – OVERHEAD DOOR

1. Basis-of-Design Product: Subject to compliance with requirements, provide Interlogix 2200 Series or comparable product by one of the following:

   a. Bosch Security Systems

   b. Honeywell International Inc.; Honeywell Security

   Description: Floor-mount SPDT switch with minimum 18-inch armored cable shall monitor door position.

2.5 MASTER CONTROL UNIT (EXISTING)

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. DSC Maxsys Series

B. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.

1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.

2. Include a real-time clock for time annotation of events on the event recorder and printer.

3. Addressable initiation devices that communicate device identity and status.

4. Control circuits for operation of mechanical equipment in response to an alarm.

C. Construction: Freestanding equipment cabinet, modular, with separate and independent alarm and supervisory system modules. Alarm-initiating protected zone boards shall be plug-in cards. Arrangements that require removal of field wiring for module replacement are unacceptable.

D. Comply with UL 609.

E. Console Controls and Displays: Arranged for interface between human operator at master control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: LCD, two lines of 40 characters, minimum.

2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer.

4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.

5. Coordinate operator commands in first subparagraph below with "Functional Description of System" Article.

6. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:

   a. Acknowledge alarm.

   b. Silence alarm.

   c. System reset.

   d. LED test.

7. Timing Unit: Solid state, programmable, 365 days.

8. Confirmation: Relays, contactors, and other control devices shall have auxiliary contacts that provide confirmation signals to system for their on or off status. Software shall interpret such signals, display equipment status, and initiate failure signals.

9. Alarm Indication: [Audible signal sounds and a plain-language identification of the protected zone originating the alarm appears on LCD display at master control unit. Annunciator panel displays a common alarm light and sounds an audible tone.] [Duress alarm activation sounds a siren and strobe as well as keypad annunciation.]

F. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of [25] percent.

G. Power Supply Circuits: Master control units shall provide power for remote power-consuming devices. Circuit capacity shall be adequate for at least a [25] percent increase in load.

H. Verify that manufacturer can provide UPS to provide a minimum of [six hours] of master control-unit operation.

I. Cabinet: Lockable, steel enclosure arranged so operations required for testing, normal operation, and maintenance are performed from front of enclosure. If more than a single cabinet is required to form a complete control unit, provide exactly matching modular enclosures. Accommodate all components and allow ample gutter space for field wiring. Identify each enclosure by an engraved, laminated, phenolic-resin nameplate. Lettering on enclosure nameplate shall not be less than 1 inch high. Identify, with permanent labels, individual components and modules within cabinets.

J. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station.

PART 3 - EXECUTION

3.1 INDENTIFICATION/LABELING

A. Label devices, switches, master control unit(s), strobes, and associated cabling with identification number/room number as indicated on the drawings. Where drawings are silent, coordinate labeling scheme with owner prior to pre-construction submittals and indicate proposed identification/labeling on pre-construction shop drawings.

B. Master Control Unit enclosures shall be labeled as follows:

1. Cover shall be identified as “Electronic Security System – Intrusion Detection – Master Control Unit (insert identifier)”

2. Cabling for devices shall be labeled at both ends with “(Device Type) – (insert identifier)”. Example: Motion Detector #12 (Corridor A101)

3.2 START-UP OF SYSTEMS

A. Prior to system start-up, conduct the following examinations:

1. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

2. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

3. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

4. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

a. Remove and replace anchors where inspections indicate that they do not comply with requirements. Re-inspect after repairs or replacements are made.

b. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

5. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

6. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 28 Section "Seismic Controls for Electronic Safety and Security."

C. Wiring Installation

1. Wiring Method: Install wiring [in metal raceways] according to Division 28 Section "Common Work Results for Electronic Security Systems". Control and data transmission wiring shall not share conduit with other building wiring systems.

2. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3. Wires and Cables:

a. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.

b. 120-V Power Wiring: Shall be by Division 26 Contractor. Coordinate final connection.

c. Control and Signal Transmission Conductors: Install shielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends unshielded cable, according to Division 28 Section "Conductors and Cables for Electronic Security."

d. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

e. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

f. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws.

D. GROUNDING

1. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

2. Ground equipment in accordance with manufacturer requirements and IEEE 1100.

3. Refer to grounding requirements of Division 28 Section “Equipment Room Fittings for Electronic Security”.

3.4 PROJECT CLOSE-OUT INSTRUCTIONS

A. Functional Testing

1. Conduct and finish functional tests of the Intrusion Detection system, and integrated testing where applicable.

2. Comply with provisions in NFPA 731, Ch. 9, "Testing and Inspections."

a. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

b. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table "Test Methods" and Table "Test Methods of Initiating Devices."

3. Documentation: Comply with provisions in NFPA 731, Ch. 4, "Documentation" and submit as part of Preliminary Project Completion Submittal as required by Division 28 Section “Electronic Security Systems”.

B. Follow all other Project Close-Out requirements as detailed in Division 28 Section “Electronic Security System”.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

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SECTION 31 00 00

EARTHWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Extent of site clearing and earthwork is shown on Drawings.

1. Site clearing includes, but is not limited to:

a. Protection of existing trees.
b. Removal of trees and other vegetation indicated.
c. Clearing and grubbing.
d. Removing below grade and above grade improvements indicated.

2. Earthwork includes, but is not limited to:

a. Site grading, stripping and removal of organic soils.
b. Dewatering, excavating, trenching, backfilling, and other earthwork operations required for utility and other underground lines and appurtenances.
c. Excavating, backfilling, and compacting for structures.

1.2 RELATED SECTIONS

A. Section 01 50 00: Temporary Facilities and Controls; for dust control, erosion and sedimentation controls, and storm water pollution controls.

B. Section 01 74 19: Construction Waste Management

C. Section 02 41 19: Building Demolition.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service:

1. Comply with pertinent provisions of Section 01 42 00.
2. Geotechnical Engineering Services: Compaction testing and compaction observation and inspection will be required. Reports shall be in conformance with Section 01 42 00.

a. Determine compaction per ASTM D 1557.
b. Comply with Title 24, Part 2, Chapter 33.

1.04 GEOTECHNICAL INVESTIGATION DATA

C. Soil, geologic, and seismic investigations were conducted at Site, and results are to be found in following report:

1. Report Job No. LA 1420 , dated 12/31/2019.
2. Report: Geotechnical Engineering Investigation
   Proposed New Classroom Building

   Clark Magnet High School, 4747 New York Avenue,
   Glendale, California

   For Glendale Unified School District

D. Report Prepared By: Group Delta Consultants, INC.
   370 Amapola Avenue, Suite 212
   Torrance, California 91204
   (310) 320 – 5100
   www.groupdelta.com

E. Geotechnical investigation data is not part of Contract Documents, but is made available by Owner as "Information Available to Bidders".

1. Bidders are strongly urged to examine entire geotechnical investigation data and make their own examination of Site prior to bidding.
2. Bidders must make their own determination of conditions which affect performance of Work.

F. Report data on indicated subsurface conditions is not intended as representations or warranties of accuracy or continuity between soil borings.

1. It is expressly understood that Owner, Architect, and Geotechnical Consultant will not be responsible for interpretations or conclusions drawn therefrom by Bidder.
2. Owner, Architect, and Geotechnical Consultant further disclaim responsibility for interpretation of data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and presence, level and extent of underground water.

G. Additional Test Borings and Other Exploratory Operations:

1. Prior to bidding, bidders may request permission to make their own subsurface investigations to satisfy themselves as to site and subsurface conditions at no cost to Owner.
   a. Such investigations may be performed only under time schedules and arrangements approved in advance by Owner and Architect.
2. Upon completion of additional exploratory work, restore Site as directed by Owner.
   a. Backfill test holes and pits using removed material.
   b. If removed material is not sufficient, provide additional compatible material of similar character to native soil.
   c. Compact backfill to same density as adjacent soil.
3. Contractor shall be fully responsible for deductions or conclusions made on basis of information or data collected from additional exploratory work.

H. Project Geotechnical Engineer will be retained by Owner to observe performance of Work in connection with building construction, and/or Soils Technician for excavating, trenching, filling, backfilling, and grading, and to perform compaction tests in accordance with DSA requirements.

I. Readjust Work performed that does not meet technical or design requirements, but make no deviation from Contract Documents without specific and written approval from Architect.

J. In addition to complying with requirements of governmental agencies having jurisdiction, comply with directives of Civil Engineer of Record, Project Geotechnical Engineer or Soils Technician, as appropriate, at Job Site during earthwork operations.

1. Notify Architect of discrepancies in specifications and actual site conditions, or of discrepancies between Civil Engineer of Record/Project Geotechnical Engineer's/Soils Technician directives and Contract Documents.

1.4 PROJECT CONDITIONS

A. Grading and Earthwork: Perform grading and earthwork in accordance with recommendations of the Geotechnical Report, except as modified here in, and by requirements of the Drawings, Specifications, as directed by the Architect.

B. Noise and Dust Abatement: Exercise reasonable and necessary means to abate dust, dirt rising and undue noise.

1. Perform necessary sprinkling and wetting of construction site to allay dust.

C. Existing Utilities: Locate existing underground utilities in areas of Work.

1. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions.
3. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
4. Repair damaged utilities to satisfaction of utility owner.
5. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
6. Demolish and completely remove from Site existing underground utilities indicated to be removed.
7. Coordinate with utility companies for shut-off of services if lines are active.

D. Use of Explosives:

1. The use of explosives is not permitted.

E. Protection of Persons and Property: Barricade open excavations occurring as part of this Work and post with warning lights..

1. Operate warning lights as recommended by authorities having jurisdiction.
2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

F. Existing Conditions: Prior to commencing Work at Site, verify agreement of existing conditions with indicated conditions.

1. Notify Architect in writing of discrepancies found.

2. Start of Work without notification constitutes acceptance of conditions, without cause for extra costs.

G. Soil Corrosivity Evaluation:

1. Chemical testing indicates that the soil may be moderately corrosive to buried metal.
2. Contractor to consult with a qualified corrosion engineer in regards to protection of buried steel or ductile iron piping and conduit.
3. Concrete cover of 3" minimum is required to provide protection for reinforcing steel.
4. Coordinate with other trades for design of improvements in contact with site soils.

H. Filled Excavations and Buried Structures: Investigate Site during clearing and earthwork operations for filled excavations, buried structures such as cesspools, cisterns, foundations.

1. If such conditions are found, immediately notify Architect.

I. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect improvements on adjoining properties and on Owner's property.
2. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

J. Protection of Existing Trees and Vegetation.

1. Comply with following:

a. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. THIS WILL BE STRICTLY ENFORCED AND THE CONTRACTOR WILL BE RESPONSIBLE FOR THE REPLACEMENT OR THE DAMAGE REPAIR OF ANY EXISTING TREE DUE TO LACK OF PROTECTION.
b. Provide temporary guards to protect trees and vegetation to be left standing.

K. Preconstruction·conference: Prior to commencing Work at Site, schedule meeting at Site with Owner, Geotechnical (Soils) Engineer, and Contractor in attendance.

1. Optional Attendees: Architect/Civil Engineer
2. Purpose of meeting is to verify agreement of existing conditions with indicated conditions and to discuss special soil handling requirements if necessary.
3. Notify Architect in writing of discrepancies found.

a. Start of Work without notification constitutes acceptance of conditions, without cause for extra costs.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material: The fill soils shall consist of materials approved by the project Soils Engineer or his representative. These materials may be obtained from the excavation areas and any

other approved sources, and by blending soils from one or more source. The material used shall be free from organic vegetable matter and other deleterious substances, and shall not contain rocks greater than eight inches (3") in diameter nor of a quantity sufficient to make compaction difficult.

PART 3 - EXECUTION

3.1 SITE CLEARING

A. General: Remove trees, shrubs, grass, weeds and other vegetation, improvements, or obstructions that interfere with installation of new construction and remove from Site.

1. Remove such items elsewhere on Site or premises as specifically indicated.
2. Removal includes new and old stumps of trees and their roots.
    a. Carefully and cleanly cut roots and branches of trees indicated to be left standing, where such roots and branches obstruct new construction.

B. Clearing and Grubbing:

1. Clear Project Site of trees, shrubs and other vegetation, except for those indicated to be left standing.
2. Completely remove stumps, roots, and other debris protruding through ground surface.
    a. Use only hand methods for grubbing inside drip line of trees indicated to be left standing.
3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
4. Place fill material in horizontal layers not exceeding 6 to 8 inches loose depth, and thoroughly compact to density equal to adjacent original ground.

3.2 EXCAVATION, GENERAL

A. Excavation consists of removal and disposal of material encountered when establishing required grade elevations.

B. Excavate the proposed construction areas down to dense alluvium.

1. Then scarify the natural ground to a depth of at least six inches (6") and moisten as required. Compact the scarified ground to at least 95 percent of the maximum laboratory density.

C. Stability of Excavations: Maintain sides and slopes of excavations in safe condition until completion of backfilling.

1. Provide not less than minimum requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

D. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill.

1. Place, grade and shape stockpiles for proper drainage.

2. Locate and retain soil materials away from edge of excavations.

E. Any unapproved fill materials encountered during grading shall be removed and replaced with engineered fill.

3.3 EXCAVATION FOR STRUCTURES

A. Remove and recompact the upper three feet (3') of the existing earth material to support the proposed structures. The compacted fill shall extend outside the footprint of the structure a distance equal to the depth of the removal, and not less than five feet (5'). A minimum of two feet (2') of earth fill shall be maintained below the foundations of the proposed structure.

B. Conform to elevations and dimensions shown within tolerance of +/- 0.10 foot, and extending sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.

C. In excavating for footings and foundations, take care not to disturb bottom of excavation.

1. Excavate by hand to final grade just before concrete is placed.
2. Trim bottoms to required lines and grades to leave solid base to receive concrete.

3.4 EXCAVATION FOR PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as shown but not less than12 inches below existing grade or finish grade, whichever is deeper.

B. Within Portland cement concrete pavement areas, remove upper 18" of existing soil below pavement finish grade or existing grade, whichever is deeper. Fill and compaction shall be carried forth as described in Article 3.08.

3.5 EXCAVATION FOR TRENCHES

A. Dig trenches to uniform width required for particular item to be installed, sufficiently wide to provide ample working room.

1. Provide 6 to 9 inches clearance on both sides of pipe or conduit.

B. Excavate trenches to depth indicated or required.

1. Carry depth of trenches for piping to establish indicated flow lines and invert elevations.

C. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6 inch layer of crushed stone or gravel prior to installation of pipe.

D. Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.

E. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Architect/Engineer/DSA Inspector.

1. Use care in backfilling to avoid damage or displacement of pipe systems.
2. Clean sand should be placed around utility lines and properly jetted. Flooding and /or jetting or utility trenches does not create compact trench backfill and should be limited to back filling around, and up to six inches (6") above, utility pipes.
3. Back fill for the remaining portion of the trench above the pipes should be placed by mechanical compaction methods to a minimum of 95% of the maximum density as determined by the latest version of ASTM D 1557. The upper twelve inches (12") of the certified fill shall be compacted to at least 95% of the maximum density in all areas where vehicle loading occurs.
4. All compaction should be tested and certified by the Architect/Engineer/SoilsTech.

3.6 DEWATERING

A. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding Project Site and surrounding area.

B. Do not allow water to accumulate in excavations.

1. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades and foundations.
2. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

C. Convey water removed from excavations and rain water to collecting or run-off areas.

1. Provide and maintain temporary drainage ditches and other diversions outside excavation limits for each structure.
2. Do not use trench excavations as temporary drainage ditches.

3.7 GRADING

A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas.

1. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent pending.

1. Where grades are not indicated, grade uniformly level or slope between points for which elevations are given.
2. In absence of more specific grading information, slope ground away from buildings for minimum distance of 20 feet, at minimum slope of 2%.
3. Grade trenches and other drainage flow lines to slope uniformly to avoid standing water.

C. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

D. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation.

1. Provide final grades within tolerance of 1/2 inch when tested with 10 foot straightedge.

3.8 FILL PLACEMENT AND COMPACTION

A. Place the approved fill material in approximately level layers six to 8 inches (6" to 8") thick, and moistened as required. Thoroughly mix each layer to attain uniformity of moisture in each layer.

B. When the moisture content of the fill is below the optimum moisture content, as specified by the Engineer, add water and thoroughly mix in until the moisture content is within two percent (+/-2%) above the optimum moisture content.

C. When the moisture content of the fill is more than two percent(+/- 2%) above the optimum moisture content, as specified by the Engineer/Soils Technician and/or DSA Inspector aerate the fill material by scarifying or blend with additional materials and thoroughly mix until the moisture content is within two percent(+/- 2%) above the optimum moisture content.

D. Compact each layer to ninety percent (95%) of the maximum density as determined by the latest version of ASTM D 1557, using approved compaction equipment.

E. Review of the fill placement shall be provided by the Engineer/Soils Technician, and/or DSA Inspector during the progress of grading. In general density tests will be made at intervals not exceeding two feet (2') of fill height or every 500 cubic yards of fill placed.

F. The materials can experience a shrinkage often to fifteen percent (10-15%).

G. During the inclement part of the year, or during periods when rain is threatening, all fill that has been spread and awaits compaction shall be compacted before stopping work for the day or before stopping because of inclement weather.
These fills once compacted, shall have the surfaces sloped to drain to one area where water may be removed.

H. Work may start again, after the rainy period, once the site has been reviewed by the Engineer/Soils Technician and/or DSA Inspector and he has given his authorization to resume. Loose materials not compacted prior to the rain shall be removed and aerated so that the moisture content of these fills will be within two percent(+/- 2%) above the optimum moisture content.

I. Surface materials previously compacted before the rain, shall be scarified, brought to the proper moisture content, and re-compacted prior to placing additional fill, if deemed necessary by the Engineer/Soils Technician, and/or DSA Inspector.

3.9 RETAINING WALLS

A. Retaining and below grade walls shall be drained with perforated pipe encased in drainage gravel. Gravel zone shall be a minimum width of 12" wide and extend a minimum 12" upward the top of the wall.

1. Perforations of drainage pipe shall be placed down and discharge away from foundations and other improvements.
2. Top of perforated pipe is to be placed below the bottom of the floor slab or pavements.

B. Backfill: The upper 12" of backfill shall consist of suitable approved material to minimize surface drainage into the wall drainage system.

Aggregate: Shall be evenly graded mixture of crushed stone no larger than 1 %" and shall conform to ASTN D448, Size 57.

C. Prefabricated drainage systems: Are acceptable alternatives in lieu of gravel but shall be reviewed and approved per Sections 01 33 13, and 01 40 00, and 01 60 00 prior to any procurement or use.

D. Grading and backfilling operations: heavy equipment shall not be allowed within a lateral distance of 5 feet from wall or within a lateral distance equal to the wall height, whichever is greater, to avoid excessive lateral pressures. Hand operated equipment is to be used in this area for compaction of backfill.

3.10 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

B. Cracking or settlement of paving or other finish materials over utility trench locations shall be conclusive proof of trench failure.

1. Remove and re-compact trench backfill material and replace damaged paving or other finish material as required at no additional cost to Owner.

3.11 MAINTENANCE

A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion.

1. Keep free of trash and debris.

B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape, and compact to required density prior to further construction.

3.12 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted on Owner's property.

B. Removal from Owner's Property:

1. Remove waste materials, including excess and unacceptable excavated material, trash and debris, and dispose of it off Owner's property in legal dump site.
2. Comply with requirements of Section 01 74 19.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping and stockpiling.
5. Removing above-grade site improvements.
6. Disconnecting, capping or sealing, and abandoning site utilities in place.
7. Disconnecting, capping or sealing, and removing site utilities.

1.2 RELETED DOCUMENTS

A. Drawings and general provision of the Contract, including Addenda, Alternates, General and Supplementary Conditions and Division 1 Specification Sections, collectively, apply to this work.

B. Section 01 50 00 - Construction Facilities and Temporary Controls for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.

C. Section 02 41 16 - Demolition for demolition of buildings, structure, and site improvement.

D. Section 31 00 00 - Earthwork for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2" (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

1.4 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing. Present and review with IOR and Project Manager before work begins.

B. Record drawings according to Section 01 77 00 - Project Closeout. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

C. Two (2) copies of permits and notices.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Construction Conferences.

B. Source Quality Control: All demolition work conducted under this section shall be done by the same subcontractor for all demolition work on this project.

C. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and 'extent to that indicated for this project.

D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

E. Refrigerant Recovery Technician Qualifications: Certified by EPA - approved program, with current EPA 608 Universal Technician cert.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
3. Maintain egress and ingress for site traffic at all times.

B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by owner before award of Contract.

C. Storage or sale of items scheduled for removal is not permitted.

D. Arrange for work to be scheduled so as to not interfere with Owner's on-site operations.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 31 00 00 - Earthwork. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways through ECP of the project.

C. Locate and clearly flag trees and vegetation to remain or to be relocated with FASO Grounds Supervisor.

D. Protect existing landscape and site improvements scheduled to remain from damage during construction. Restore damaged improvements to their original condition, as acceptable to Owner.

E. Contractor shall contact the local service alert company for information on buried utilities and pipelines prior to commencement of site clearing.

F. Conduct demolition to minimize interference with adjacent structures, trees, and properties.

G. Provide, erect, and maintain temporary barriers and security devices.

3.2 TREE PROTECTION

A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.

1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

1. Cover exposed roots with burlap and water regularly.
2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
3. Coat cut faces of roots more than 1-1/2" (38 mm) in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
5. Water trees and other vegetation to remain within limits of contract work as required to maintain their health during course of construction progress.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect and District Grounds Supervisor, in like size, and type, at Contractor expense.

1. Employ a qualified arborist, licensed in jurisdiction where Project is located to submit details of proposed repairs and to repair damage to trees and shrubs.
2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.3 UTILITIES

A. Locate, identify, disconnect, and seal or cap off, with like materials, utilities indicated to be removed or abandoned. Owner will arrange to shut off indicated utilities when requested by Contractor in writing with a minimum of five (5) working days notice when approved.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect and Owner's Representative not less than five (5) working days in advance of proposed utility interruptions and secure written approval 48 hours before scheduled interruption.
2. Do not proceed with utility interruptions without Architect's and Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 24" below exposed subgrade.
4. Use only hand methods for grubbing within drip line of remaining trees.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 8" (200 mm) loose depth, and compact each layer to a equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping soil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Limit height of topsoil stockpiles to 72" (1800 mm).
2. Do not stockpile topsoil within drip line of remaining trees.
3. Dispose of excess topsoil as specified for waste material disposal.
4. Stockpile surplus topsoil and allow for respreading deeper topsoil.

3.6 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements in conjunction with Building Demolition - Section 02 41 19, as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavements. Saw-cut faces vertically.

C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

3.7 DISPOSAL

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property. Do not allow materials and/or debris to accumulate on site.

B. Burning of materials and debris is not permitted on Owner's property.

END OF SECTION

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SECTION 31 23 23

EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 31 00 00 - Earthwork.

3. Section 32 12 13 – Asphaltic Concrete Paving.

4. Section 32 13 13 – Concrete Paving.

5. Section 33 10 00 - Water Distribution.

7. Section 33 40 00 - Storm Drainage.

8. Division 22 - Plumbing.

9. Division 26 - Electrical.

1.02 PROJECT REQUIREMENTS

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.

2. Bonds: Post as required by authorities having jurisdiction over the area.

3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.03 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.

1.04 TESTING

A. OWNER will retain a Geotechnical Engineer as an OWNER Consultant who will provide observations, tests, inspections and approvals identified in the Contract Documents as being responsibility of OWNER.

B. Imported Soils: The Geotechnical Engineer will obtain initial product Sample for testing in accordance Article 3.02 of this Section.

1.05 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Bedding material from trench bottom to one foot above the pipe:

1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.

2. Sand complying with the Specifications for cement concrete aggregates.

B. Backfill Materials:

1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2 ½-inch in any dimension.

2. Cement-sand slurry shall be provided with one sack of cement per cubic yard of the mixture.

3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 60 percent of fines passing a 200 mesh sieve. Material shall provide a coefficient of expansion of not more than two percent from air dry to optimum moisture content and not more than six percent from air dry to saturation. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.

PART 3 - EXECUTION

3.01 GENERAL

A. Before initiating intrusive activities, contact Underground Service Alert of Southern California (USA or Dig Alert) to obtain a Dig Alert ticket for location information on buried public and USA member utilities and pipelines at least 48-hours prior to beginning work. A copy of the Dig Alert ticket shall be forwarded to the OWNER. For on-site utilities, retain a state-licensed third party underground utility locating service.

B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence as specified in Section 01 5000, Construction Facilities and Temporary Controls, and in accordance with Cal-OSHA standards and requirements.

C. Saw-cut concrete or bituminous paving for trench installation.

D. Trenches over 5 feet in depth shall conform to the Cal-OSHA.

E. Where indicated and required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

G. Do not install piping lengthwise under concrete walks without review by the ARCHITECT.

H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of two horizontal to one vertical, from a line 9 inches above bottom of footings.

1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

Steel Pipe	24 inches below finished grade
Copper Water Tube	18 inches below finished grade
Cast-Iron Pressure Pipe	36 inches below finished grade
Plastic Pipe (other than waste)	30 inches below finished grade
Tanks or other structures	36 inches below finished grade
Soil, Sewer & Storm Drain	minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
Irrigation Pipe:	nonpressure pipe 12 inches, pressure pipe 24 inches

2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.

I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and tanks.

L. Do not install backfill until required inspections and testing is completed.

M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Project Inspector.

N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 90 percent of the maximum density.

O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.

P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.

Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements.

3.02 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2, Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. Imported fill materials will be sampled by the Geotechnical Engineer for compliance with the requirements of Part 2 of this Section.

D. The Geotechnical Engineer will perform the tests by utilizing an independent approved testing laboratory.

E. Initial sampling will be performed by the Geotechnical Engineer before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The Geotechnical Engineer will obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.

F. The Geotechnical Engineer will perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1,000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1,000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.

G. The independent approved testing laboratory will perform the required tests and report results of all tests noting if the tested material passed or failed such tests and will furnish copies to the Project Inspector, ARCHITECT, OAR, DSA, CONTRACTOR, and others as required. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, CBC and the DSA. Upon completion of the Work of this Section, the independent testing laboratory and Geotechnical Engineer will submit a verified report to the DSA as required by CBC.

H. Bills of lading or equivalent documentation will be submitted to the Project Inspector on a daily basis.

I. Upon completion of import operations, provide the OAR a certification statement attesting that imported material has been obtained from the identified source site.

3.03 INSPECTION AND TESTING

A. The Geotechnical Engineer will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D1557, method "C."

3.04 PROTECTION

A. Protect the Work of this Section until Substantial Completion.

3.05 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

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SECTION 32 01 17

ASPHALT PAVEMENT REPAIR

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Bituminous Surfacing Repair: Areas removed for utility trenches, heaved by tree roots, cracked areas, protruding areas where pavement meets hard surfaces, depressed areas, holes and areas around new structures, and raveled bituminous pavement.

2. Areas heaved by tree roots, cracked areas, holes and trenches, and areas around new structures.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 31 23 23 - Excavation and Fill for Utilities.

3. Section 32 12 13 - Asphaltic Concrete Paving.

4. Section 32 13 13 – Concrete Paving.

5. Section 32 12 36 - Seal for Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating areas to be repaired.

B. Product Data: Submit manufacturer’s technical data for materials and products.

1.03 QUALITY ASSURANCE

A. Comply with Standard Specifications for Public Works Construction, current edition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Asphalt paving materials: Section 32 12 13 – Asphaltic Concrete Paving.

B. Seal materials: Section 32 12 36 - Seal for Bituminous Surfacing.

C. Headers: Section 32 12 13 – Asphaltic Concrete Paving.

2.02 BITUMINOUS MATERIALS

A. Provide materials and products of the class, grade or type indicated, conforming to relevant provisions of Section 203 - Bituminous Materials of the latest Standard Specifications for Public Works Construction.

PART 3 - EXECUTION

3.01 PAVEMENT REMOVAL

A. Remove bituminous and concrete pavement in accordance with applicable provisions of Section 300 - Earthwork of the Standard Specifications for Public Works Construction.

B. Pavement Heaved by Roots: Remove pavement to limits of distortion and expose roots. Trim roots to provide at least 12-inch clearance to pavement.

C. Remove protruding bituminous surfaces flush with the surrounding grade using a suitable tool or equipment so that adjacent finishes are not blackened.

D. Remove raveled and depressed bituminous pavement to limits indicated or required.

E. Saw cut existing improvements, trim holes and trenches in bituminous and concrete pavement to permit mechanical hand tampers to compact the fill.

F. Remove broken concrete by saw cutting. If the required cut line is within 30 inches of a score or joint line or edge, cut and remove to the score, joint line, or edge.

3.02 EXCAVATING, BACKFILLING AND COMPACTING

A. Conform to requirements in Section 31 23 23 - Excavation and Fill for Utilities, as required.

B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with a required material. Install and compact fill materials in accordance with the requirements of related Specification sections.

3.03 HEADERS

A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of the adjacent undisturbed grade.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid earth a minimum of 12 inches. Stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header. Provide a minimum of two 12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and devices as required to fasten headers.

3.04 BASE COURSE

A. Unless otherwise indicated, base course shall be crushed aggregate base, fine grade, 3 inches thick or equal to thickness of the existing base, whichever is greater.

3.05 RESURFACING

A. Holes and Trenches: Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing. Resurface flush with existing adjoining pavement installing the same type of materials and section provided in existing improvements.

B. Other Areas: Other surface improvements damaged or removed shall be cut to a neat even line and excavated one inch below the bottom of the existing pavement. Resurface by following the original grades and installing the same type of materials provided in existing improvements.

C. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth materials before asphalt cools.

3.06 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces: Prior to filling cracks, clean existing bituminous surfacing of loose and foreign materials and coat with a film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks ½ inch wide and less with RS-1 emulsion and silica sand or other required material. Cracks larger than ½ inch wide shall be filled with Type C2 Asphalt Concrete as specified. Cracks shall be filled to the level of adjacent surfacing.

2. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt. Install material, strike off the emulsified asphalt with a straightedge flush with adjoining surfacing. Finish with a steel trowel, and after dehydration, compact by rolling or tamping.

C. Testing: Flood test entire area in presence of the Project Inspector. Entire area tested shall be free of standing water or puddles.

D. Surface Seal: After surface has been repaired and tested, install seal coat over entire area indicated. Surface seal shall be as specified in Section 32 1236 - Seal For Bituminous Surfacing.

3.07 CLEANING

A. Remove all stains on the Project site and adjacent properties caused by or attributed to the Work of this section.

B. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.08 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION

SECTION 32 12 13

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

B. Single course bituminous concrete paving.

C. Slurry seal.

1.2 RELATED SECTIONS

A. Section 01 33 00 - Submittals

B. Section 01 74 19 - Construction Waste Management.

C. Section 32 13 13 - Concrete Paving

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data with application or installation instructions for proprietary materials.

1. Indicate compliance with requirements.

B. Material Certificates: Provide copies of materials certificates signed by material producer and contractor, certifying that each material item complies with, or exceeds, specified requirements.

C. Weighmaster Certificates: Furnish licensed weighmaster certificates with each load of asphaltic concrete delivered to Project.

1. Yield of asphaltic concrete material shall be 24 lbs. per sq. ft. of paving area based on 2 inch thickness after rolling.

a. 5% tolerance will be allowed between total calculated weight and actual weight incorporated in work.

2. Deliver certificates to Owner's representative, who will collect certificates and ensure that material represented by each certificate is actually incorporated in Work.

D. HPI Submittals:

1. Minimum Recycled Content Levels: Provide documentation consisting of receipts or proof of purchase for recycled crushed miscellaneous base indicating minimum 50 percent by weight of recycled content.

1.4 QUALITY ASSURANCE

A. Standard: Provide aggregate base, asphaltic concrete, and installation complying with Standard Specifications for Public Works Construction, latest edition; hereafter referred to as A Standard Specifications@, except as otherwise indicated

1. Aggregate base may contain recycled material as specified in Division 31.

B. Comply with Geotechnical Report for design and compaction recommendations under paving.

1.5 PROJECT CONDITIONS

A. Do not place asphaltic concrete when atmospheric temperature is below 40 degrees F or during unsuitable weather.

B. Grade Control: Establish and maintain required lines and elevations

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood Headers, Stakes, Benders and Splices: "Construction Heart" grade redwood as graded by Redwood Inspection Service.

1. Minimum 2 by thick lumber for headers and stakes and minimum 1 by thick boards for splices.

2. Use galvanized nails for fastening.

B. Herbicide Treatment: Commercial chemical for weed control, registered by Environmental Protection Agency.

1. Provide granular, liquid, or wettable powder form.

2. Manufacturers: Subject to compliance with specified requirements, provide products of one of following:

a. Ciba-Geigy Corp.
b. Dow Chemical U.S.A.
c. E.I. Du Pont du Nemours & Co., Inc.
d. FMCCorp.
e. Thompson-Hayward Chemical Co.
f. U.S. Borax and Chemical Corp.

C. Tack Coat: Standard Specifications, Section 302-5.4, Emulsified asphalt.

D. Base Course: Standard Specifications, Section 200-2.4, crushed miscellaneous base, rolled thickness as indicated.

E. Surface Course:

1. Vehicle Traffic: Per Special Provision of Standard Specification Committee, January 1, 2006, Performance Grade "PG 64-10", 1/2 inch maximum aggregate, "Medium" grading, rolled thickness as indicated.

F. Slurry Seal: Emulsion-aggregate slurry complying with Standard Specifications, Section 203-5, Type 1.

G. Pavement Marking Paint: Alkyd-resin type, ready-mixed, complying with AASHTO M-248, Type N; VOC compliant.

1. Colors as indicated on plans.

H. Concrete Wheel Stops: Precast, air-entrained concrete, smooth finish, 3,000 psi minimum compressive strength, with continuous steel reinforcing, approximately 6 inches high, 9 inches wide, and length as shown.

1. Provide length of 72 inches, unless otherwise indicated.

2. Provide chamfered corners and drainage slots on underside.

3. Provide holes for anchoring to substrate.

4. Dowels: Galvanized steel, diameter 3/4 inch, minimum length 10 inches.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before applying herbicide treatment.

B. Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction.

C. Notify Contractor of unsatisfactory conditions. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.

D. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions.

1. Comply with all requirements of the Healthy Schools Act of 2000

2. Apply to compacted, dry subbase.

3. Take extreme precaution to confine weed killer to only those areas to be covered by asphaltic concrete, and provide necessary protection to prevent injury or damage to life and property.

3.2 WOOD HEADERS

A. Install along edges of asphaltic concrete paving except where concrete paving, walks and curbs occur.

1. Set top edge of header to conform to grade of asphalt paving.

2. Benders of lesser thickness may be used to form returns.

B. Space stakes not to exceed 4 feet on centers, unless otherwise noted.

1. Drive stakes to depth of 1 inch below top of header and nail to headers.

C. Splice joints between individual header boards with 1 by thick board same height as header and not less than 24 inches long.

3.3 PLACING OF BASE COURSE

A. Spread specified base material to a thickness providing compacted thickness shown on Drawings.

1. Compact to 95% at or above optimum moisture content.

B. Moisture Content: Use only amount of moisture needed to achieve specified compaction.

3.4 PLACING SURFACE COURSE

A. Place surface course within 48 hours of placing base course.

B. Prime Coat: Apply prime coat to base course at rate of 0.10 to 0.25 gal. per sq. yd. of surface.

1. Lightly sand prime coat not absorbed by base.

C. Tack Coat: Apply to contact surfaces of previously constructed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement.

1. Distribute at rate of 0.05 to 0.15 gal. per sq. yd. of surface.

2. Allow to dry until at proper condition to receive paving.

D. Place asphalt concrete mixture on prepared surface, spread and strike-off.

1. Spread mixture at minimum temperature of 250 degrees F.

2. Place inaccessible and small areas by hand.

3. Place each course to required grade, cross-section, and compacted thickness.

E. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.

F. Begin rolling when mixture will bear roller weight without excessive displacement.

1. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

G. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge.

1. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

H. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot.

1. Continue second rolling until mixture has been thoroughly compacted.

I. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks.

1. Continue rolling until roller marks are eliminated and course has attained maximum density.

J. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work.

1. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course.

2. Clean contact surfaces and apply tack coat.

3.5 SLURRY SEAL

A. Apply to asphaltic concrete paving, following Standard Specifications, Section 302-4.

B. Do not place slurry seal when atmospheric temperature is below 65 degrees F during unsuitable weather.

1. Prior to placing slurry seal: Clean dirt, mud, trash or other loose material from area to be covered.

C. Allow asphaltic concrete surface course to cure 72 hours before placing slurry seal.

D. Immediately preceding placing of slurry seal mixture, uniformly dampen pavement surface by application of approximately 0.10 to 0.20 gal. of water per sq. yd. of surface.

E. Apply to a finished thickness of approximately 1/8 inch and not less than 1/16 inch of greater than 3/16 inch in thickness: remove spillage.

1. Ridges or bumps in finished surface will not be permitted.

F. Protect slurry seal from damage by traffic until such time that mixture has cured sufficiently so that slurry seal will not adhere to and be picked up by tires of vehicles.

3.6 PATCHING AND PROTECTION

A. Patching: Remove and replace paving areas mixed with foreign materials and defective areas.

1. Cut-out such areas and fill with fresh, hot asphalt concrete.

2. Compact by rolling to maximum surface density and smoothness.

B. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

1. Protect seal coats from damage by traffic until such time that mixture has cured sufficiently so that seal coat will not adhere to and be picked up by tires of vehicles.

C. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.7 FIELD QUALITY CONTROL

A. General: Test-in-place asphalt concrete courses for compliance with requirements for Thickness, surface smoothness and density.

1. Repair or remove and replace unacceptable paving as directed by Architect.

B. Testing Agency: Owner shall engage qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency shall conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

2. Additional testing and inspecting, at Contractors expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness.

1. Base Course: +/-1/2 inch.

2. Surface Course: +/-1/4 inch.

D. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10 foot straightedge applied parallel with, and at right angles to centerline of paved area.

1. Surfaces will not be acceptable if exceeding following tolerances for smoothness.

a. Base Course Surface: 1/4 inch.
b. Wearing Course Surface: 3/16 inch.

E. Densities:

1. Density of asphalt concrete after rolling shall be 95% of density obtained with California Kneading Compactor per California Test 304.

2. Density of aggregate base course shall be 95% of maximum relative compaction in accordance with ASTM D 1557.

F. Flood Test: Prior to application of seal coat, perform flood test in presence of Architect.

1. Method:

a. Flood entire asphalt concrete paved area with water by use of tank truck or hoses.
b. If depression occurs, where water ponds to depth of more than 1/8 inch, fill or otherwise correct to provide proper drainage.

c. Feather and smooth edges of fill so that joint between fill and original surface is invisible.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

END OF SECTION

SECTION 32 12 36

SEAL FOR BITUMINOUS SURFACING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Surface sealer over bituminous surfacing.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 01 17 – Asphalt Pavement Repair.

3. Section 32 12 13 – Asphaltic Concrete Paving.

4. Section 32 17 23 - Pavement Marking.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product information and application procedures for bituminous surfacing.

1.03 QUALITY ASSURANCE

A. Comply with the Standard Specifications for Public Works Construction, current edition.

B. Agitate bulk materials during transport.

1.04 MAINTENANCE

A. Extra Materials: Provide 10 gallons in unopened containers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following surface seals:

	Product Name	Manufacturer
1.	Guard-Top	CALMAT / Industrial Asphalt
2.	Over Kote	Diversified Asphalt Product

3. Park Top Western Colloid Products

4. Sure Seal Asphalt Coating Engineering

5. Super Drive Top. SAF– T Seal. Inc.

6. Equal.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter.

3.02 APPLICATION

A. Install seal coat in strict accordance with manufacturer's written directions and recommendations.

B. Install two coats of surface seal to new bituminous surfacing. First coat shall be installed before flood testing. Clean surface and allow to dry before installing second coat. Second coat shall be installed after bituminous surfacing has passed flood test.

C. Where new bituminous surfacing is installed adjacent to existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

D. Where existing bituminous surfacing is indicated to be patched and sealed, install two coats of surface seal after patching. Refer to Section 32 12 16 - Asphalt Paving.

3.03 PROTECTION OF SURFACES

A. Protect sealed and unsealed surfaces from damage and traffic during performance of the Work of this section and until surface seal has thoroughly set and cured. Do not permit traffic of any kind for at least 24 hours after completion of installation.

B. Protect the Work of this section until Substantial Completion.

3.04 TESTING

A. Owner reserves the right to obtain samples, perform tests to ensure compliance with the Specifications, and to review weight slips and invoices of materials delivered to the Project site.

3.05 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 13 13

CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes exterior Portland cement concrete paving for the following:
1. Curbs and gutters.

2. Walkways.

B. Related Sections: The following Sections contain requirements that relate to this Section:
1. "Earthwork" for subgrade preparation, grading and base course.

2. "Cast-in-Place Concrete" for general building applications of concrete.

4. "Paving Joint Sealants" for joint fillers and sealants within concrete paving and at joints with adjacent construction.

1.3 SYSTEM DESCRIPTION

A. Provide concrete pavement according to the materials, workmanship, and other applicable requirements of the following standard specifications:
1. Reference Specification: Perform all work in accordance with applicable provisions of "Standard Specifications for Public Works Construction", latest edition. Unless otherwise noted, mention herein of section numbers refers to sections of the Reference Specification. Where Reference Specification refers to "Agency", substitute the word "Owner". Where Reference Specification refers to "Engineer", substitute the word "Architect". Where Reference Specification is in conflict with these Specifications, these Specifications shall govern.

2. Measurement and payment provisions and safety program submittals included in Reference Specifications do not apply to this Section.

1.4 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. Minutes of pre-installation conference.

1.5 QUALITY ASSURANCE

A. Concrete Standards: Comply with provisions of the following standards, except where more stringent requirements are indicated.

1. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."

2. ACI 318, "Building Code Requirements for Reinforced Concrete."

3. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Concrete Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Concrete Testing Service: Engage a qualified independent testing agency to perform materials evaluation tests and to design concrete mixes.

D. Field-Constructed Mockup: Cast mockup of size required (but not less than 10 feet by 10 feet) to demonstrate typical joints, surface finishes, textures, color, and standard of workmanship.

1. Notify Architect a minimum of 4 days in advance prior to applying sandblast finish to mock-up. Apply sandblast finish in the presence of the Architect and adjust finish as required by the Architect.
2. When Architect determines that mockup does not meet requirements, demolish and remove it from the site and cast another until the mockup is accepted.
3. Keep accepted mockup undisturbed during construction as a standard for judging completed paving. Undamaged mockup may be incorporated into the Work.
4. Demolish accepted mockup and remove from site when directed by Architect.

E. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. Before installing Portland cement concrete paving, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, independent testing agency, and other concerned entities to review requirements. Notify participants at least 3 working days before conference.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.

1. Use flexible or curved forms for curves of a 100-foot or less radius.

B. Form Release Agent: Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Debond Form Coating, L & M Construction Chemicals.

b. Crete-Lease 880 VOC, Cresset Chemical Company.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 40 for #3 bars and Grade 60 for bars larger than #3, deformed.

B. Plain, Cold-Drawn Steel Wire: ASTM A 82.

B. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

C. Dowel Sleeves: Speed Dowel, Aztec Concrete Accessories, Inc.

D. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

E. Supports for Reinforcement: Chairs, spacers, dowel bar supports and other devices for spacing, supporting, and fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications.
1. Use supports with sand plates or horizontal runners where base material will not support chair legs.

2.3 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type V.

1. Use one brand of cement throughout Project. Coordinate with Section "Cast-In-Place Concrete."

2. Provide white cement when required to achieve specified color in integral colored concrete.

B. Normal-Weight Aggregates: ASTM C 33, Class 4M non-reactive, and as follows. Provide aggregates from a single source.
1. Maximum Aggregate Size: 1-inch.

2. Do not use fine or coarse aggregates that contain substances that cause spalling.

3. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength and durability by special tests or actual service may be used when acceptable to Architect.

C. Water: Potable.

D. Admixtures: Comply with requirements specified in Section "Cast-In-Place Concrete."

1. Integral Colored Concrete: Use admixtures only as approved by the color pigment manufacturer. Do not use admixtures that will alter the color of integral colored concrete.

2. Do not use admixtures containing calcium chloride or chloride ions.

2.4 CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.

B. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.

1. Waterproof paper.

2. Polyethylene film.

3. White burlap-polyethylene sheet.

C. Liquid Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B. Moisture loss not more than 0.55 kg./sq. meter in 72 hours when applied at a rate of 200 sq. ft./gal.

1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2. Products: Subject to compliance with requirements, provide one of the following:

a. L & M Cure R, L & M Construction Chemicals, Inc.

b. 1100-Clear, W.R. Meadows, Inc.

3. Do not use sodium silicate type curing agents.

4. For integral colored concrete plaza and stair pavement, provide curing compound meeting the specified requirements and approved by the manufacturer of the integral color pigments for use on integral colored concrete paving. Coordinate with manufacturer of integral colored concrete pigments and determine compatibility of the curing compound with integral color pigment. Curing compound manufactured by the pigment manufacturer that also meets the requirements of this Section is acceptable.
   a. Do not use curing compound that will alter the color of integral colored concrete.

D. Evaporation Control: Monomolecular film-forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Eucobar; Euclid Chemical Co.

b. E-Con; L&M Construction Chemicals, Inc.

c. Confilm; Master Builders, Inc.

2.5 RELATED MATERIALS

A. Bonding Agent: Acrylic or styrene butadiene, complying with ASTM C 1059, Type 2.

B. Epoxy Adhesive: ASTM C 881, two-component material suitable for dry or damp surfaces. Provide material type, grade, and class to suit requirements.

C. Products: Subject to compliance with requirements, provide one of the following:

1. Bonding Agent:

b. SBR Latex; Euclid Chemical Co.

c. Daraweld C; W.R. Grace & Co.

d. Everbond; L&M Construction Chemicals, Inc.

e. Acryl-Set; Master Builders Inc.

2. Epoxy Adhesive:

a. Burke Epoxy M.V., The Burke Co.

b. Concresive Standard Liquid; Master Builders, Inc.

c. Rezi-Weld 1000; W.R. Meadows, Inc.

3. Color Pigments:

a. Davis Colors, Davis Colors Co.
b. Chromix Admixtures, L. M. Scofield Co.

D. Concrete Sealer: Water-based, deep penetrating, non-staining, non-darkening silane micro emulsion.

1. Positive chloride-ion screening, prevents water intrusion, minimizes rebar corrosion and potential concrete spalling, and protects against damaging effects of alkalis and other contaminants.

2. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
a. Pentane WB, L & M Construction Chemicals, Inc. This product is intended to establish the characteristics and level of quality intended for this Project.

2.6 CONCRETE MIX

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301. For the trial batch method, use a qualified independent testing agency for preparing and reporting proposed mix designs.

1. Do not use the Owner's field quality-control testing agency as the independent testing agency.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties:

1. Compressive Strength (28-Day): 3200 psi, for traffic rated pavement.

2. Compressive Strength (28-Day): 3000 psi, for curbs and gutters.

3. Compressive Strength (28-Day): 3000 psi, for all other site concrete.

4. Minimum cement content: shall be 5-1/4 sacks per cubic yard.

5. Maximum concrete slump: shall be 3 inches, plus or minus 1/2 inch, for all walks; and 4 inches, plus or minus 1 inch for all other Portland cement concrete paving, except for integral colored concrete paving maintain a slump of 3 inches.

6. Water/Cement Ratio: shall be less than or equal to 0.5.

C. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

D. Admixtures: Comply with requirements specified in Section "Cast-In-Place Concrete".

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94.

1. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

2.8 HERBICIDE TREATMENT

A. Commercial chemical for weed control, registered by Environmental Protection Agency. Provide granular, liquid, or wettable powder form.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include, but are not limited to, the following:

a. Ciba-Geigy Corp.

b. Dow Chemical U.S.A.

c. E.I. Du Pont de Nemours & Co., Inc.

d. FMC Corp.

e. Thompson-Hayward Chemical Co.

f. U.S. Borax and Chemical Corp.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Proof-roll subgrade to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.

B. Remove loose material from compacted subgrade surface immediately before placing concrete.

C. Herbicide Treatment: Apply chemical weed control agent in strict compliance with manufacturer's recommended dosages and application instructions. Apply to compacted, dry subgrade prior to application of prime coat.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:

1. Top of Forms: Not more than 1/8 inch in 10 feet.

2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 PLACING REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

3.4 JOINTS

A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.

1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

2. Make joints, including sawed joints, full depth required and from edge to edge of paving.

B. Contraction Joints: Provide weakened-plane contraction joints, sectioning concrete into areas approximately 10 feet square, unless otherwise shown on Drawings. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:

1. Tooled Joints: Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radiused jointer tool.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into hardened concrete when cutting action will not tear, abrade, or otherwise damage surface and before development of random contraction cracks.
3. Inserts: Form contraction joints by inserting pre-molded plastic, hardboard, or fiberboard strips into fresh concrete until top surface of strip is flush with paving surface. Radius each joint edge with a jointer tool. Carefully remove strips or caps of two-piece assemblies after concrete has hardened. Clean groove of loose debris.

C. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.

1. Continue reinforcement across construction joints unless indicated otherwise. Do not continue reinforcement through sides of strip paving unless indicated.

2. Provide tie bars at sides of paving strips where indicated.

3. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

4. Locate construction joints to correspond with a planned contraction joint or score line as shown on the drawings.

D. Isolation Joints:

1. Isolation-Type Joints: Form isolation joints of preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects.
2. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint

E. Installation of joint fillers and sealants is specified in Division 7 Section "Paving Joint Sealants."

F. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Moisten subgrade or base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

C. Comply with requirements and with ACI 304R for measuring, mixing, transporting, and placing concrete.

D. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

E. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

F. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

G. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.

H. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete.

I. Cold-Weather Placement: Comply with provisions of ACI 306R and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.

4. Do not place concrete on surfaces that are frozen.

J. Hot-Weather Placement: Place concrete complying with ACI 305R and as specified when hot weather conditions exist.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.

3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.6 CONCRETE FINISHING

A. Float Finish: Begin floating when bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Finish surfaces to true planes within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line texture finish.

2. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating surface 1/16 inch to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3. Do not use troweling machines within 12 inches of electrical junction and outlet boxes which are set to finish flush with concrete slabs. Float and trowel such areas by hand with wood floats and steel trowels, taking care to see that concrete is finished flush with box cover and matches adjacent surfaces.

4. Portland cement concrete paving shall have a medium salt (medium broom) finish on all surfaces sloped less than 6% and slip resistant (heavy broom finish) on all surfaces sloped greater than 6%.

B. Finishing formed surfaces:

1. Curb forms shall leave a smooth face.

2. Remove all fins.

C. Provide steel trowel finish on tops of curbs and flow lines of curbs, gutters and integral curb and gutters.

D. Final Tooling: Tool edges of paving, gutters, curbs, and joints formed in fresh concrete with a jointing tool to the following radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 1/4 inch.

2. Radius: 3/8 inch.

E. Finish surfaces to produce a uniform appearance throughout area involved and throughout adjacent areas with the same treatment.

F. Where concrete finishing occurs adjacent to finished metal or other surfaces, particularly where serrated or indented surfaces occur, remove all traces of cement film before allowing to harden.

G. Apply integral wood float and broom finish to the all concrete pavements and walkways, unless otherwise shown on the Drawings.

1. After screeding and compacting, finish with a wood float using a circular motion to produce a uniform texture and finish throughout.

2. For vehicular traffic areas, the finish shall be coarse enough to provide a non-slip surface with a minimum static friction coefficient of 0.6.

3. For pedestrian traffic areas, finish shall be a non-slip surface with a minimum static coefficient of friction of 0.6.

4. Tests for coefficient of friction shall be either ASTM C-1028 (field test) or ASTM D-2047 (laboratory test).

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.

B. Evaporation Control: In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure integral colored concrete by curing compound as approved by the manufacturer of the color pigments used in the concrete mix. Cure other concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:

a. Water.

b. Continuous water-fog spray.

c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with a 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

E. Spray-apply concrete sealer to all concrete pavement. Comply with sealer manufacturer's application instructions.

3.8 FIELD QUALITY CONTROL TESTING

A. The Owner will employ a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include the following:

1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.

a. Slump: ASTM C 143; one test at point of placement for each compressive-strength test but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.

b. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test but no less than one test for each day's pour of each type of air-entrained concrete.

c. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.

d. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

e. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.

2. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

3. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.

4. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.

5. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

B. Test results will be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.

C. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

D. Additional Tests: The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

E. Manufacturer's Field Service: When placing integral colored concrete, arrange for the services of a qualified technical representative of the color pigment manufacturer, equipped with wet-batch color control test devices to ensure concrete of uniform color and matching approved mock-up.

3.10 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this Section. Concrete which is not true to line and plane, which is not thoroughly troweled and properly surfaced as required, which varies in excess of 1/4-inch along a 10-foot straight edge, which is scuffed or has a rough top surface, except where required, or which does not connect properly to adjoining work, does not slope as required for drainage or is not properly cured, will be deemed defective.

1. General: Patch defective areas immediately following form removal. Remove defective concrete to a width and depth necessary for proper patching, but in no case less than 1 inch deep. Make the walls of the cut area perpendicular to the surface and do not feather out the edge. Dampen the patch area and the adjacent area 6 inches around the patch area.

2. Exposed concrete: Prepare a patching mortar of one part Portland cement, adjusted to match the color of the surrounding concrete, and 2-1/2 parts sand with the least water required to produce a workable mass. Re-work this mortar until it is the stiffest consistency that will permit placing. Brush the patch area with a bond of neat cement and water paste and apply patching mortar when the water sheen is off the bond. Strike off the mortar slightly higher than the surrounding surface, let set for 1 hour and finish flush with the surrounding surface.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 13 73

PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 02 Section "Cement Concrete Pavement" for constructing joints in concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
3. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products specified.

B. Or Equal: Where products are specified by manufacturers name and accompanied by the term “or equal”, comply with provisions in Division 01 Section “Product Requirements”, Part 2 “Product Substitutions” Article. Specific procedures must be followed before use of an unnamed product or manufacturer.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Owner’s Representative from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multicomponent Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: ASTM C-1247; ASTM C-920-98, Type M; Grade NS; Class 25; Uses T, M, and O.

a. Products:

1) Pecora Corporation; Dyna Tred.
2) Or equal.

2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

a. Products:

1) Meadows, W. R., Inc.; Sealtight Gardox.

2) Or equal.

3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

a. Products:

1) Tremco Sealant/Waterproofing Division; Vulkem 202.
2) Or equal.

B. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

a. Crafco Inc.; RoadSaver Silicone.
b. Dow Corning Corporation; 888.
c. Or equal.

C. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:

a. Crafco Inc.; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Or equal.

D. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Products:

a. Meadows, W. R., Inc.; Sof-Seal.
b. Or equal.

2.4 HOT APPLIED JOINT SEALANTS

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

1. Products:

a. Crafco Inc.; Superseal 444/777.
b. Meadows, W. R., Inc.; Poly-Jet 3406.
c. Or equal.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

1. Products:

a. Koch Materials Company; Product No. 9005.
b. Koch Materials Company; Product No. 9030.

c. Meadows, W. R., Inc.; Sealtight Hi-Spec.
d. Or equal.

2.5 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

2.6 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

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.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

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SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Parking stripes, markings and accessibility symbols.

2. Fire lane “No Parking.”

3. Curb marking and red curbs.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 32 1236 - Seal Bituminous Surfacing.

1.02 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings, indicating location, extent, color and texture of markings.

B. Material Samples: Submit color Samples.

1.03 PROJECT CONDITIONS

A. Do not install markings when adverse weather conditions are forecast.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paint: Water emulsion-based traffic paint.

1. Dunn Edwards: Vin-L-Stripe.

2. Pervo Paint Company: Acrylic Traffic Paint.

3. Sherwin Williams: Setfast Acrylic Traffic Paint.

4. Vista Paint Corporation: Traffic Paint.

5. Equal.

PART 3 - EXECUTION

3.01 PAVEMENT MARKINGS

A. Application of Paint:

1. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.

2. Provide mechanical equipment to apply paint in a uniform, straight or curved pattern, without gaps, holidays, runs, or other defects.

3. Do not permit traffic until paint has completely cured.

4. Apply two coats in thickness recommended by manufacturer.

5. Playground Markings: Submit Samples to Architect for review.

B. Marking Width and Color: Unless indicated otherwise, marking width and color are as follows:

Location	Width	Color
Parking stall lines	4 inches	White
Traffic markings		
Striping:	4 inches	Yellow
General	4 inches	Yellow
Accessible Parking	4 inches	Blue
International Symbol of Accessibility (ISA)	2 inches	White on blue background

*Where two sets of lines overlap, one set shall be white and the other set shall be yellow.

3.02 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.03 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Chain link fences and gates as indicated.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 03 30 00 - Cast-in-Place Concrete.

3. Section 31 00 00 - Earthwork.

4. Section 31 10 00 – Site Clearing.

5. Section 32 01 17 - Pavement Repair.

1.02 SUBMITTALS

A. Shop Drawings: Submit dimensioned plans and details indicating extent of fences, locations of gates, and details of attachment and footings. Indicate means and methods for surface preparation and finishing.

B. Certifications: Manufacturers material certifications in compliance with the ASTM standards referenced in this Section.

1.03 REFERENCES

A. ASTM A392: Standard Specification for Zinc-Coated Steel Chain Link Fence Fabric.

B. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

C. ASTM A824 – Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.

D. ASTM F552 - Standard Terminology Relating to Chain Link Fencing.

E. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

F. ASTM F567: Standard Practice for Installation of Chain Link Fence.

G. ASTM F626 - Standard Specification for Fence Fittings.

H. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.

I. ASTM F900 - Standard Specification for Industrial and Commercial Swing Gates.

J. ASTM F934 - Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.

K. ASTM F1083: Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

L. ASTM F1184: Standard Specification for Industrial and Commercial Horizontal Slide Gates.

M. ASTM F1664 – Standard Specification for Poly Vinyl Chloride (PVC) and Other Conforming Organic Polymer-Coated Steel Tension Wire Used with Chain-Link Fence.

N. ASTM F2200 - Standard Specification for Automated Vehicular Gate Construction.

O. UL 325 - UL Standard for Safety Door, Drapery, Gate, Louver, and Window Operators and Systems.

1.04 QUALITY ASSURANCE

A. Manufacturer: Company specialized in manufacturing chain link fence products with at least five years of experience.

B. Fence Installer: Company with demonstrated successful experience installing similar projects and products in accordance with ASTM F567 and with at least five year experience.

PART 2 – PRODUCTS

2.01 CHAIN LINK FABRIC

A. Galvanized Chain Link Fabric: Conforming to ASTM A392, Class 2 zinc coating, 2.00 ounces minimum per square foot of uncoated wire surface, hot-dipped galvanized after weaving, and with top and bottom edges knuckled (kk). Tie wires and hog rings shall conform to ASTM F626, and shall be 9 gage and galvanized.

B. Chain Link Fabric Requirements:

1. Fabric for perimeter fencing and interior fencing shall be 9 gage woven wire with 2 inch mesh, unless otherwise specified.

2. Installed fence fabric shall be free from barbs, icicles, or other projections. Fence fabric with such defects will be deemed defective Work.

2.02 STEEL FENCE FRAMEWORK

A. Posts, Top Rails, Brace Rails and Gate Frames: Standard weight, galvanized, welded steel pipe conforming to ASTM F1083, Group IA Heavy Industrial Fence Framework, with a minimum yield strength of 30,000 psi. Minimum 1.8 Oz/ft^2 hot dipped zinc coating average for interior and exterior.

B. Schedule of Posts, Rails, Bracings and Footings: Unless indicated otherwise on the drawings, shall be of sizes indicated on the following schedule.

Item	Height	Nominal Pipe Size (inches)	Outside Diameter (inches)	Weight (pounds per foot)	Footings	
					Diameter(inches)	Depth (inches)
Top Rail, Brace Rails and Transom Rails	Up to 10’-0”	1-5/8	1.660	2.27	N/A	N/A
	10’-1” to 16’-0”	1-7/8	1.900	2.72	N/A	N/A
Line Posts	Up to 6’-0”	2-3/8	2.375	3.65	12	24
	6’-1” to 8’-0”	2-3/8	2.375	3.65	12	36
	8’-1” to 10’-0”	2-7/8	2.875	5.80	12	36
	10’-0” to 16’-0”	3-1/2	3.5	7.58	14	60
	14’-0” to 16’-0”	4	4.000	9.12	14	60
Terminal, Corner, Angle & Pull Posts	Up to 8’-0”	2-1/2	2.875	5.79	12	36
	8’-0” to 10’-0”	2-1/2	2.875	5.79	14	42
	10’-1” to 16’-0”	3	3.5	7.58	14	60
Pedestrian Gate Posts	Up to 8’-0”	2-1/2	2.875	5.79	14	36
Gate Frames	Up to 8’-0”	1-1/2	1.900	2.72	N/A	N/A
Driveway Double-Leaf Swing Gate Posts: Opening						
Up to17'-3-1/2"	Up to 8’-0”	3 1/2	4	9.11	16	42
17'-4" to 20'-3-1/2"	Up to 8’-0”	3-1/2	4	9.11	16	42

2.03 FITTINGS

A. Fittings shall be malleable iron conforming to ASTM F626.

B. Post Caps: Designed to fit snugly over posts with a minimum projection of 1-1/2 inches below top of posts. Post caps shall be manufactured with a curved top.

C. Eye Tops: Designed to fit over line posts, and for through passage of top rail.

D. Expansion Sleeve Couplings for Top Rails: Steel, 6 inches long, designed to fit tightly on inside of rail, fitted with raised center.

E. Rail Ends for Top Rails and Brace Rails: With holes to receive 3/8 inch bolts for securing to rail end bands.

F. Tension Bands and Bands for Securing Rail Ends: Mild steel flats, at least 11 gage x one inch, tension bands in gates shall be 11 gage by 1 inch. Bolts for use with tension bands and rail end bands shall be galvanized machined 3/8 inch by 1 ½-inch.

G. Tension Bars: Mild steel flats at least 3/16 inch by 3/4 inch.

2.04 TENSION WIRE

A. 6 gage marcelled steel wire conforming to ASTM A824, Type II Class 5 zinc coated, 2.00 ounces minimum per square foot of uncoated wire surface. Wavy type wire is not acceptable.

B. Polymer Coated: Galvanized tension wire shall be as specified on above paragraph, with polymer coating conforming to ASTM F1664. Color shall match fabric and shall be in compliance with ASTM F934.

C. Turnbuckles for installation with Tension Wires: Eye and hook type, drop forged steel, right and left hand threads, at least 3/8 inch screw diameter with at least 4 ½-inches of take-up.

2.05 PAINT FOR GALVANIZING REPAIR

A. Paints for Refurbishing Galvanizing: Organic zinc-rich paint conforming to ASTM A780. Paints used on the site shall be approved by OWNER's Office of Environmental health and Safety (OEHS).

2.06 GROUT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout specifically recommended by manufacturer for interior and exterior applications "Rapid set Cement".

2.07 GATES

A. General:

1. Gate framework shall be fabricated of tubular steel of sizes indicated on the drawings and conforming to ASTM F1083, Group IA, with a minimum yield strength of 30,000 psi. Joints at corners shall be miter cut and continuously welded to sides.

2. Install fence fabric to side members with tension bars and tension bands as specified, spaced not more than 14 inches apart. Tension bars shall extend full height of gate. Install fence fabric to top and bottom members and to brace rail with wire ties as specified for top rails, spaced not more than 12 inches apart. Chain link fabric shall match adjacent fence system.

3. Latches and Hinges: Weld gate latches and strikes to gate posts and frames. Weld hinges to posts. Welding shall be performed before gate frames are galvanized, or welds shall be finished as specified below.

4. Grind welds flush and smooth. Hot-dip galvanize fabricated parts after welding, or be protected by zinc-rich paint in conformance to ASTM A780.

B. Swing Gates: Galvanized steel welded fabrication in conformance with ASTM F900, fabric size and gage shall match fence. Positive locking gate latch shall be fabricated of 5/16 inch thick by 1 ¾ inch pressed steel galvanized after fabrication.

2.08 PRIVACY FENCE SLATS

A. Flat tubular shape with bottom lock track fabricated of PVC material with UV inhibitors.

B. Privacy Percentage Factor: 95%.

2.09 CONCRETE

A. Comply with requirements of Section 03 3000, Cast-in-Place Concrete. Provide normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi, 4-inch slump, and one inch maximum size aggregate.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to the following Sections for earthwork related work:

1. Section 31 00 00 - Earthwork.

2. Section 32 01 17 - Pavement Repair.

3.02 FRAMEWORK INSTALLATION

A. Install fences as indicated on Drawings.

B. Space fence posts at equal intervals between terminal, angle, corner, and gate posts, and not more than 10 feet apart measured from center to center of posts. In curved fence sections having a radius of 50 feet or less, space posts not more than 5 feet - 6 inches apart. Install posts so that top of eye of post caps are level with top of fabric.

C. Install angle or corner posts at each change in direction of 15 degrees or more, at change of 5 percent or more in grade of fencing, and at the beginning and end of curved fence sections.

D. Install terminal posts at ends of runs of fencing. Install gateposts on both sides of driveway and pedestrian gates. For double-leaf gates, net opening between gate posts shall be gate size as indicated on Drawings, plus 3 ½-inches; for single leaf gates, net opening shall be gate size plus 2 ½-inches.

E. Embed posts into footing 6 inches less than the depth of the footing unless noted otherwise on drawings.

F. Where a fence is to be installed on a curb, construct footings with top of footing level with the lower finish grade. Align posts, set plumb and true before placing footings. Remove splattered concrete from exposed pipe surfaces while concrete is still soft. In bituminous surfaced areas, install seal coat on top of concrete footings.

G. Install fences with top rail. Top rail shall pass through eye tops and be secured at ends with rail-end fittings and bands.

H. Provide a transom rail and fabric at top of pedestrian gate openings. Install transom rail 6 feet 8 inches above high point of grade at gate opening. Ends of transom rails shall be pinned or riveted to rail end fittings with 1/4 inch mild steel rivets. Pin or rivet shall go through rail and peen. Welding on rail ends is not permitted.

I. Install bottom tension wire a minimum of 3 inches from grade for fencing and secure to fence posts with ties. Provide a turnbuckle for each 150 feet of wire or fractional part thereof. Turnbuckles are not required in runs of 15 feet or less. Install ends of tension wires to posts in a

manner to prevent slipping or loss of tension. Wrap should start from fence side of post. Turn end of wire around post tightly twisted at least three times around wire. At turnbuckles, wire through eye and tightly twist end at least three times around wire. Cut tail of bottom wire flush.

3.03 CHAIN LINK FABRIC INSTALLATION

A. Install fence fabric on outward facing side of posts, except for tennis courts. Install fence fabric with top edge projecting above top rail of fence.

B. Install bottom of fence fabric to clear finish grades, except on bituminous surface install 3/4 inch above such surface. Locally shape and trench ground surfaces where necessary to provide uniform top and bottom alignment of fence.

C. Tightly stretch fabric and at terminal, pull corner, angle, and gateposts, secure with tension bars extending full height of fence. Secure tension bars to posts with bolted tension bands spaced not more than 14 inches apart.

D. Bands and Ties: Install bands and ties in accordance with following schedule:

15 bands on 16 feet fence	16 ties on 16 feet fence
11 bands on 12 feet fence	12 ties on 12 feet fence
7 bands on 8 feet fence	7 ties on 8 feet fence
6 bands on 6 feet fence	6 ties on 6 feet fence
4 bands on 4 feet fence	4 ties on 4 feet fence

E. Fasten fabric to line posts with wire ties spaced not more than 16 inches apart. Where 6 gage aluminum ties are furnished, hook the tie at both ends. Installation of hooked ties with links is not permitted.

F. Fasten fabric to top rails, mid-rails, brace rails, with wire ties spaced not more than 18 inches apart. Bend back ends of tie wires so as not to be a hazard. At bottom tension wire, install hog rings spaced not more than 18 inches apart. Where 2 fabrics are furnished, lap the fabrics one mesh at mid-rail and tie both fabrics with 9 gage wire or 6 gage aluminum ties to midrails.

3.04 WELD GRINDING

A. Grind all field welds smooth, clean off flux and spatter, damaged galvanizing removed, burrs and projections ground off, properly prepared, then heavily coated with galvanizing repair coating. Install coating in accordance with written recommendations of manufacturer.

3.05 INSTALLATION ON TOP OF CONCRETE WALLS

A. Posts for fences on top of new concrete or concrete masonry walls shall be installed in 24 gage galvanized iron inserts one inch larger than the outside post diameter. Wall thickness for such installation shall be 8 inches minimum. Depth of embedment of post shall not be less than 15 inches for fence height not exceeding 4 feet. Install post plumb, true, and fill joint space with non-shrink grout, finished flush with top of wall. Remove excess grout and clean posts.

B. Fencing on Gravity Walls: Post of fence not exceeding 8 feet high shall have a minimum of 15 inches embedment in gravity walls with a top width of 10 inches minimum and side of 1H: 4V. Where the height of gravity wall from top to bottom, within 5 feet from each side of a post, is less than 22 inches, provide concrete fence post footings and embed posts in accordance with the schedule of posts and footings as set forth in this section.

3.06 ALTERATIONS TO EXISTING FENCING

A. Resetting Fences:

1. Existing fences shall be reset where finish pavement is raised or lowered more than 6 inches from existing grade. Remove and reinstall entire fence assembly as specified in this Section.

   a. Where the finish grade is raised 6 inches or less, cut and re-knuckle the existing fence fabric. Adjust tension wire and tie to fabric. Bottom of fence fabric shall be installed ¾" above finish grade.

   b. Where the finish pavement is lowered 6 inches or less, demolish the fence footing flush with the finish grade and adjust the fabric and its attachments. Bottom of fence fabric shall be installed ¾ inches above finish grade.

2. Where existing fencing posts are indicated to be removed, reset or relocated, remove posts including their concrete footings

   a. Fill footing cavity with sand, compact and cap surface matching existing adjacent material.

   b. Construct new concrete footings, as specified, in their designated location and set posts as indicated above in Framework Installation Article.

3. Bent posts, rails and accessories shall be replaced with new parts as specified to complete reinstallation. New materials shall closely match design of existing installation. Cut bent portion of posts and weld new sections of equal diameter and thickness. Install splice to inside of all welded section prior to welding. Previously repaired or welded posts shall be replaced.

4. Top rail is required in reinstalled fencing which does not have top rail in its existing condition. Install as specified for new installations.

5. Fabric Removal: Do not remove more than what can be replaced during one day unless a barricade, providing equal security, will be installed in its place. If freestanding temporary fence is used, it shall be clamped and wrap tied.

6. Remove and dispose of off-site concrete debris, chain link, hardware and accessories. Use new hardware and accessories.

7. Gates:

   a. Remove non-welded type existing hinges and replace with OWNER provided weldable hinges. On existing welded hinges remove bolts and replace with new. Remove existing latches and replace with new.

   b. Weld gate latches and hinges to posts as indicated for new fencing.

B. Painting: Disassemble existing fence and all attachment hardware (bands, pipe, and wire) prior to preparation of posts for painting. Replace attachment hardware with new.

1. Preparation: Prepare exposed steel posts, rails and accessories thoroughly cleaned of rust, oil and foreign materials. Painted galvanized metal shall be stripped to bare metal before applying prime coat.

2. Priming: Spot prime areas from which the original surface coating had been removed with a metal primer to match adjoining surfaces. Subsequently, install a prime coat to the entire surface to be painted.

3. First Coat: Install first coat as recommended by the paint manufacturer. Furnish a color that is 10 percent to 15 percent lighter or darker than the finish coat.

4. Second or Finish Coat: Install finish coat after the first coat has cured.

5. Install paint in accordance with manufacturer's written recommendations.

6. Protect adjacent structures, walls, concrete or asphalt from paint.

3.07 INSTALLATION OF GATES

A. Provide gates of the sizes indicated on Drawings. Allow clearance on gates of 1-1/2 inches at bottom and one inch at top. Construct gates installed in sloping areas to conform to the grade. Provide an opening in each gate for access to locking device or padlock. Knuckle ends of fabric cut for opening to eliminate hazards.

B. Sliding Gates and Swing Gates: Fabricate and install as indicated on Drawings. Wheel housing shall be designed to fit tightly to roll track and prevent gate from rolling over objects. Unsupported cantilever type roll gates are not acceptable. Install gate stops in accordance with the drawings. Both top and track stops are required.

3.08 COMPLETION

A. Completed fencing shall form continuous units between points indicated with required parts, accessories, and fittings provided and installed. Clean exposed metal surfaces of cement, grout and other foreign substances.

B. Fill in holes left by removal of existing fence footings, except in areas where grading Work is indicated or specified, to existing grade with clean earth thoroughly compacted to at least same density as adjoining soil.

3.11 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.12 CLEANUP

A. Remove rubbish, debris and waste materials and legally dispose of off the Project site.

END OF SECTION

SECTION 33 10 00

WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site water piping and fittings including domestic potable waterline and fire protection system supply waterline, valves, and fire hydrants.

B. Connection of site water system to municipal water systems.

1.2 RELATED SECTIONS

A. Division 31 Earthwork (Excavation, Backfill, and Compaction)

B. Division 32 Irrigation Systems

C. Division 21 Fire Suppression (See Architectural/Building Specifications)

D. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Society of Mechanical Engineers (ASME) latest edition

1. B 16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

B. American Society for Testing and Materials (ASTM) latest edition

1. B88 Seamless Copper Water Tube
2. F477 Elastomeric gaskets and lubricant

C. American National Standards Institute (ANSI) latest edition

1. A21.8

D. American Water Works Association (AWWA) latest edition

1. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
2. C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
3. C110 Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches, for Water and Other LiquidsRubber-Gasket Joints for Ductile Iron
4. C111 Pressure Pipe and Fittings

5.	C116	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Service
6.	C151	Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids
7.	C153	Ductile-Iron Compact Fittings for Water Service
8.	C200	Steel Water Pipe 6 Inches and Larger
9.	C500	Gate Valves for Water and Sewage Systems
10.	C502	Dry-Barrel Fire Hydrants
11.	C504	Rubber-Seated Butterfly Valves
12.	C509	Resilient-Seated Gate Valves for Water Supply Service
13.	C550	Protective Interior Coatings for Valves and Hydrants Installation of
14.	C600	Ductile-Iron Water Mains and Appurtenances Installation of Grooved and Shouldered Joints
15.	C606	Disinfecting Water Mains
16.	C651	

E. National Fire Protection Associations (NFPA)

1.	NFPA 13	Installation of Sprinkler Systems
2.	NFPA 24	Installation of Private Fire Service Mains and Their Appurtenances

1.4 QUALITY ASSURANCE

A. Products, where marked for compliance with code or test standards, shall also mark specific standard as required in the Contract Documents.

B. Perform installation in accordance with utility company or municipality requirements.

C. Valves: Manufacturer's name and pressure rating marked on valve body.

D. Perform disinfection of potable lines in accordance with AWWA C651.

1.5 SUBMITTALS

A. Product Data: Provide Project Engineer with data on pipe materials, pipe fittings, hydrants, valves, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed state or local requirements.

C. Furnish 1 copy of results of meter test and hydrostatic pressure test to Owner and utility company upon completion of water distribution backfilling operations.

D. Project Record Documents:

1. Disinfection report; record:
   a. Type and form of disinfectant used.
   b. Date and time disinfectant injection start and time of completion.
   c. Test locations.
   d. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   e. Date and time of flushing start and completion.

f. Disinfectant residual after flushing in ppm for each outlet tested.

2. Bacteriological report; record:
   a. Date issued, project name, testing laboratory name, address, and telephone number.
   b. Time and date of water sample collection.
   c. Name of person collecting samples.
   d. Test locations
   e. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
   f. Coliform bacteria test results for each outlet tested.
   g. Certification that water conforms, or fails to conform, to bacterial standards.
   h. Bacteriologist's signature and authority.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and top of pipe elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

PART 2 - PRODUCTS

2.1 PIPE

A. Pipe sizes less than 3-inches that are installed below grade and outside building shall comply with one or combination of following:

1. Seamless Copper Tubing: Type "K" soft copper, ASTM B 88.
   a. Fittings: Wrought copper (95-5 Tin Antimony solder joint), ASME B 16.22.

B. Pipe sizes 3-inches and larger that are installed below grade and outside building shall comply with one or combination of following:

1. Gray Cast Iron Water Pipe: ANSI A21.6, thickness class 22, pressure class 150.
   a. Fittings: Either mechanical joint or push-on joint, AWWA C110 or AWWAC111.
   b. Elastomeric gaskets and lubricant: ASTM- F477.

2. Ductile Iron Water Pipe: AWWA C151, thickness class 50.
   a. Fittings: Either mechanical joint or push-on joint, AWWA C110 or AWWAC111.
   b. Elastomeric gaskets and lubricant: ASTM- F477.

2.2 GATE VALVES- 2-LNCHES AND LARGER

A. Manufacturers: Mueller Resilient Wedge Gate Valves or approved equal.

B. AWWA C500, Iron body, non-rising stem with square nut, single wedge, resilient seat, class 150flanged or mechanical joint ends, control rod, post indicator where indicated on Construction Drawings, extension box and valve key.

2.3 BALL VALVES - 2-LNCHES AND SMALLER

A. Manufacturers: Mueller Oriseal or approved equal.

B. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.4 BUTTERFLY VALVES- FROM 2-LNCHES TO 24-LNCHES

A. AWWA C504, Iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.5 CHECK VALVES, POST INDICATOR VALVES, FIRE DEPARTMENT CONNECTION, DOUBLE DETECTOR CHECK VALVES AND BACKFLOW PREVENTORS

A. Refer to local governing agency for specification and detail of the required construction item.

2.6 FIRE HYDRANTS

A. Fire Hydrants: Type as required by utility company/Local Fire Department and as shown on Construction Drawings.

B. Hydrant Extensions: Fabricate in multiples of 6-inches with rod and coupling to increase barrel length.

C. Hose and Steamer Connections: Match sizes with utility company, with two hose nozzles, one pumper nozzle.

D. Finish: Apply primer and 2 coats of enamel or special coating to color as required by utility company.

2.7 ACCESSORIES

A. Thrust Blocking: Place 3000 psi concrete to provide sufficient bearing area to transmit unbalanced thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 pounds per square foot when water main pressure is 100 psi.

MINIMUM THRUST BLOCKING BEARING AREAS

Pipe Diameter	Tees Sq. Ft	goa Bend Sq. Ft	45° Bend Sq. Ft	22‰ Bend Sq. Ft.	11W Bend Sq. Ft.	Cap/Plug Sq. Ft.
3"	**1.5**	1.0	1.0	1.0	1.0	1.5
4"	2.0	1.5	1.0	1.0	1.0	2.0
6"	3.0	3.0	1.5	1.0	1.0	3.0
8"	5.5	5.5	2.3	1.1	1.0	4.0
10"	8.2	8.2	3.4	1.6	1.0	6.0
12"	11.6	11.6	4.8	2.3	1.1	8.5

B. Locked mechanical joint fittings shall be installed where vertical changes in direction are required and, if approved by Owner and governing authority, can be installed in lieu of above thrust blocking requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and depth are as indicated on Construction Drawings.

3.2 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe for connections to equipment with flanges or unions.

D. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 TRENCHING AND BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 23.

3.4 INSTALLATION- PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions with least interference with operation of existing pipeline and in compliance with local utility company.

F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

G. Establish elevations of buried piping in accordance with Section 31 23 23.

H. Backfill trench in accordance with Section 31 23 00. Install trace wire continuous over top of non-metal pipe. Bury a minimum of 6 inches below finish grade, and above pipeline.

3.5 INSTALLATION- VALVES AND HYDRANTS

A. Install gate valves as indicated on Construction Drawings. Support valve on concrete pads with valve stem vertical and plumb. Install valve boxes in manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Construction Drawings in vertical and plumb position with steamer/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to street, roadway, or parking lot drive or toward protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly brace on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6-cubic feet of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

3.6 INSTALLATION – POST INDICATOR VALVES, FIRE DEPARTMENT CONNECTION, AND DOUBLE DETECTOR CHECK VALVES

A. Install Post Indicator Valve, Fire Department Connection, and Double Detector Check Valve as indicated on the Construction Drawings in accordance with local governing agencies.

3.7 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Contractor to disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts per million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part per million. Flush water discharged from water supply lines or hydrants shall not be allowed to discharge directly onto exposed soil or turf which could result in erosion of soil. If potential for erosion exists at discharge point, measures shall be taken to prevent erosion. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriologically test in accordance with AWWA C651. Do not place distribution system in service until approval is obtained from local governing authorities.

B. Contractor shall provide a means of neutralizing the super-chlorinated water before releasing into the environment. This may be accomplished by either a method of dechlorinization, or any method acceptable to federal, state, and local codes. Contractor shall not release super-chlorinated water directly into the sanitary sewer system, private or public, nor any storm drain system.

3.8 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventor (if required) and water meter with by-pass valves and sand strainer.

3.9 FIELD QUALITY CONTROL

A. Perform compaction testing of trench backfill in accordance with Section 31 23 23.

B. Test water distribution system pipe installed below grade and outside building in accordance with the following procedures:

1. Perform testing of pipe materials, joints, and other materials incorporated into construction of water mains and force mains to determine leakage and water tightness. Test pressure pipeline in accordance with Section 4 of AWWA C600 and NFPA 24. In the event state or local code requires more stringent test, more stringent test shall take precedence.
2. Pressure Test: After pipe has been laid, subject newly laid pipe or valved section to hydrostatic pressure of at least 1.5 times working pressure at point of testing and not less than 1.25 times working pressure at highest point along test section.
3. Leakage Test: Conduct leakage test concurrently with pressure test. Leakage is defined as quantity of water that must be supplied into newly laid pipeline or valved section thereof to maintain pressure within 5 psi of specified test pressure after air in pipeline has been expelled and pipeline has been filled with water. Leakage shall not be measured by drop in pressure in test section over period of time.
   a. Pipeline installation will not be accepted if leakage is greater than that determined by the following formula:

$$L = \frac{SD.VP}{133200}$$

L = allowable leakage, (gallons per hour)
S =length of pipe tested, (feet)
D =nominal diameter of pipe, (inches)
P = average test pressure during test, (psig)

4. Visible Leakage: Repair visible leaks regardless of amount of leakage measured.
5. Acceptance of Installation: If test of pipe laid in place discloses leakage greater than that specified, Contractor shall, at his own expense, locate leak and make repairs as necessary until leakage is within specified allowance. Supply water for testing at no expense to Owner.

END OF SECTION

SECTION 33 40 00

STORM DRAINAGE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Site storm sewer drainage piping, fittings, accessories, and bedding.

B. Connection of building storm water drainage system to municipal storm sewers.

C. Catch basins, paved area drainage, site surface drainage, and stormwater detention facilities.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 – Flashing and Sheet Metal

B. Section 31 00 00 - Earthwork

C. Section 03 30 00- Cast-In-Place Concrete: (See Architectural/ Building Specifications)

D. Kristar Enterprises, Inc. FloGard Perk Filter Concrete Catch Basin (Single Cartridge) Manufacturer's Specifications and Details

E. Kristar Enterprises Inc. CUDO Stormwater Systems - Manufacturer Specifications and Details

F. NDS Atrium Grate – Manufacturer Specifications and Details

G. Construction Drawings

1.3 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition

1. M36 Zinc Coated (Galvanized) Corrugated Iron or Steel Culverts and Under Drains.
2. M170 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
3. M190 Bituminous Coated Corrugated Metal Culvert Pipe and Arches.
4. M198 Joints for Circular Sewer and Culvert Pipe Using Flexible Watertight Gaskets.
5. M252 Corrugated Polyethylene Drainage Tubing, 3 to 10 Inch Diameter.
6. M294 Corrugated Polyethylene Drainage Tubing, 12 to 48 Inch Diameter.
7. MP7-97 Corrugated Polyethylene Drainage Tubing, 54 to 60 Inch Diameter.

B. American Society for Testing and Materials (ASTM) latest edition

1. A74 Cast Iron Soil Pipe and Fittings.
2. A185 Steel welded Wire Fabric, Plain, for Concrete Reinforcement.
3. A615 Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
4. A746 Ductile Iron Gravity Sewer Pipe.
5. C76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
6. C150 Portland Cement.
7. C206 Finished Hydrated Lime.
8. C443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
9. C478 Precast Reinforced Concrete Manhole Sections
10. C564 Rubber Gasket for Cast Iron Soil Pipe and Fittings
11. C924 Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.
12. C949 Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
13. C969 Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
14. C990 Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
15. D3034 Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
16. D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
17. D3350 Polyethylene Plastic Pipe and Fitting Materials.
18. F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
19. F949 Poly (Vinyl Chloride)(PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.
20. F1417 Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
21. F2306 12 to 60 Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications.

C. American Concrete Institute (ACI)

1. ACI 301 Structural Concrete for Buildings

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide shop drawings for precast inlets, catch basins and junction boxes.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.5 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.6 PROJECT CONDITIONS

A. Coordinate work with termination of storm sewer connection outside building including connection to municipal storm sewer system.

PART 2 - PRODUCTS

2.1 STORM SEWER PIPE MATERIALS AND FITTINGS

A. Reinforced Concrete Pipe (RCP): ASTM C 76, Class Ill, wall B (Class V under Railroads) except as noted on Construction Drawings, installed with flexible plastic, bitumen gaskets at joints.

1. Gaskets: Joint material for RCP shall be rubber gasket conforming to the requirements of ASTM C443 or "tongue and groove" type filled with cement mortar.

2. Flared end sections shall be class 1

B. High Density Polyethylene Pipe (HOPE) Smooth Interior/Annular Exterior: AASHTO Designation M252 Type S, M294 Type S and MP7-97 Type S. Only permitted when specifically indicated on Construction Drawings. Pipe shall be installed in accordance with pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications.

1. Pipe Joints and fittings shall conform to AASHTO M252 and M294.

2. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", HANCOR, INC. "Hi-Q", or approved equal.

C. Polyvinyl Chloride (PVC) Pipe: ASTM D 3034, rated SDR 35, continually marked with manufacturer's name, pipe size, cell classification, SDR rating, and ASTM D 3034 classification. Only permitted when specifically indicated on Construction Drawings.

1. Pipe joints: Joints for PVC shall conform to ASTM D 3212 using restrained gasket conforming to ASTM F477.

D. Subdrains: Shall be perforated, PVC or Flexible corrugated plastic pipe as specified herein of the size indicated on the construction drawings.

2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

A. Lid and frame per details shown on Construction Drawings.

1. Pedestrian-safe grates are required in high-traffic areas. Acceptable products include: Neenah R-1881 Series Narrow-Slotted Grates; East Jordan Iron Works V-57XX-80 Series grates; Bass & Hays Foundry VFG Pedestrian Rated Series.

B. Structure construction in accordance with details shown on Construction Drawings

C. Cast-In-Place concrete for drainage structures including: manholes, inlets, catch basins, collars, support blocks, headwalls and paved ditches shall conform to ACI 301 and applicable reference specification therein and the following:

1. Compressive Strength – 3200 psi at 28 days.

2. Reinforcement – ASTM A615, grade 40 or 60 deformed reinforcing bars. Or A185 for wire fabric

D. KriStar FloGard Perk Filter Concrete Catch Basin (Single Cartridge) to be installed per manufacturer's specification.

E. Kristar CUDO Stormwater System to be installed per Manufacturer's Specification.

F. NOS Atrium Grate to be installed per Manufacturer's Specification.

G. Cement Mortar used for paving inverts, filling lift holes, joints, patching and anchoring castings shall consist of one part portland cement, type I, ASTM C150, 1/4 part hydrated lime, ASTM C206 and 2-1/2 parts clean, well-graded sand and water free of suspended matter, alkali, and containing no industrial or domestic waste.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter that could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 23.

3.4 INSTALLATION- PIPE

A. The pipe shall be inspected for defects and cracks before being carefully lowered into the trench, piece by piece. Any defective, damaged or unsound pipe or any pipe that has had its grade disturbed after laying shall be taken up and replaced. Open ends shall be protected with a stopper to prevent earth or other material from entering the pipe during construction. The interior of the pipe shall be free from dirt, excess water and other foreign materials as the pipe laying progresses, and left clean at the completion of the installation.

B. Installation shall commence at the lowest point for each segment of the route. RCP shall be laid with the groove or bell end upstream. Riveted CSP shall be placed with the inside circumferential laps pointing downstream. Applying bituminous material conforming to AASHTO M190 shall repair damaged bituminous coating on CSP.

C. Lay pipe to the required line and slope gradients with the necessary fittings, bends, manhole, risers and other appurtenances placed at the required location as noted on Construction Drawings.

D. Do not displace or damage pipe when compacting.

E. No pipe shall be laid in water or when trench conditions are unsuitable for such work.

F. Joints:

1. Joints shall be constructed as described herein and in accordance with manufacturers installation instructions with the intent that they be made watertight.
2. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, butting the inside of the bell with a cement mortar before joining shall make the joints. The inside joint can be wiped clean of excess mortar by brush or a squeegee drawn through the pipe as the laying operations progress. In the lager diameters, which permit the entry of a man, an annular space is provided between pipe sections which shall be completely filled with mortar and finished off smooth with the inside surface of the pipe.
3. CSP shall be joined by standard corrugated connecting bands. Care shall be used to keep dirt or gravel out from between the pipes and band so that corrugations fit snugly. While being tightened, the bands shall be tapped with a mallet to take up slack and insure a tight joint.
4. PVC fittings shall be attached to the pipe by solvent welding according to the manufacturers recommendations.

3.5 INSTALLATION- CATCH BASINS, INLETS, AND JUNCTION BOXES

A. Precast Sections:

1. Precast section with bases shall be installed in accordance with Section 31 00 00 or as shown on construction drawings.

2. Pipe openings shall be aligned to that of the pipe entering and leaving the manhole, etc. Pipe shall be properly aligned with connections to manholes, etc. as shown on the construction drawings.

B. Cast-In-Place sections shall be as shown on the drawings and in accordance with Section 03 30 00.

1. Form bottom of excavation clean and smooth to correct elevation.
2. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe to be placed at proper elevation.
3. Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe in accordance with details shown on Construction Drawings.

C. Invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Invert channels and structure bottoms shall be shaped with cement mortar. Changes in size and grade of invert shall be made gradually and evenly. Changes in direction of the sewer entering branch or branches shall have a true curve of as large a radius as the manhole will permit.

D. Frames and Covers:

1. Frames and covers shall be set to the proper elevation. The frames shall be firmly embedded in mortar approximately 1 inch thick and aligned to fit the top section of the structure.
2. Bricks set in mortar used to adjust the frame to finished grade shall be limited to no more than four courses.
3. Adjustment rings used to make adjustments in grade shall be made with the initial ring embedded in mortar and the exterior of the rings parged with mortar not less than 1/2 inch thick. No adjustment made in this manner shall exceed 8 inches.

E. Concrete cradles shall be constructed as shown on the construction drawings and as needed when crossing over and under sewer pipe or utility lines. Concrete is to be 3000 psi mix with a minimum thickness of 6 inches.

F. KriStar FloGard Perk Filter Concrete Catch Basin (Single Cartridge) to. be installed per manufacturer's specification.

G. Kristar CUDO Stormwater System to be installed per manufacturer's specification.

H. NOS Atrium Grate to be installed per manufacturer's specification.

3.6 SUBDRAINS

A. Subdrains shall be installed in accordance with the details and at the locations shown on the construction drawings

3.7 INSPECTION AND TESTING

A. General

1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the construction drawings.
2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the construction drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the construction drawings and specifications and ready for use.

B. Cleaning and Testing

1. The contractor is to visibly inspect and remove all debris and obstructions from storm pipe. All storm pipe is to be tested for infiltration and exfiltration by hydrostatic testing per ASTM C969. All manholes and pipe shall meet ASTM C969 leakage criteria.

C. Alignment Test

1. After backfill has been placed and compacted to a depth not less than one foot above top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

END OF SECTION