SUMMARY OF THE WORK

PART 1 - GENERAL

1.01

1. The furnishing of all labor, materials, equipment, services, and transportation of Woodrow Wilson Middle School Main Line Copper piping at 1221 Monterey Rd, Glendale, CA 91206, as set forth in the Contraction Documents which is required for the completion of the project in accordance with the provisions of the contract

2 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.

3. 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.

4 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.

5 All project close-out/punch list 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.

6 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.

7 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.

8 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 Inspector of record (actual hours spent @$80.00/hour) shall be back-charged to the Contractor, in addition to the liquidated damages, if any, imposed upon the Contractor for late performance. THIS PARAGRAPH WILL BE STRICTLY ENFORCED.

9. 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

PART 2 – SCOPE OF WORK

2.01

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:

2.0 A. Woodrow Wilson Middle School Main Line Copper piping at 1221 Monterey Rd, Glendale, CA 91206,

1) Demo and tear down old existing Galvanized piping
2) Trench the concrete area for the new concrete
3) Install approximately 400 feet of copper piping
4) Tear out approximately 30 x 40 feet of concrete and re-pour sloped downwards with #4 re-bar
5) Hook up new pipes to feeds in tunnel
6) Hook up pipe from inside tunnel to 1000 and 3000 building using new trench and tunnel
7) Contractor is to install new pipes and hook into 3000 building pressure and check valves regulators
8) Contractor is responsible for all bracing in the tunnel
9) Contractor is responsible for all materials
10) Contractor is to cap off any non-used or fed lines
11) Contractor is to make and adhere to all local and state plumbing codes
12) Contractor is to re-attach all of feed in tunnel to main building
13) Contractor is responsible for disposal of all debris and old materials
14) Contractor is responsible to run a underground detection to be sure path is clear
15) Contractor is responsible for all machines and tools

DEMOLITION PROCEDURES

PART 5 - GENERAL

1.01 SECTION INCLUDES

A. General requirements for special project procedures pertaining to the alteration or modification of existing construction, and are complimentary to like requirements indicated or specified elsewhere. Principals items included are:

1. Removals, cutting, alterations and repairs to existing facilities as required to complete work.

2. Relocation and reinstallation of existing construction and finish.

3. Salvage, storage and protection of existing items to be reinstalled.

4. Salvage and delivery to the District of items so designated for removal and salvaged by Contractor, as directed.

1.02 RELATED SECTIONS

A. Requirements of other Sections of this Specification apply to this Section.

1.03 PROPERTY INVENTORY

A. District property that the District intends to remove, will be removed at no cost to Contractor, before a room or space is vacated for the Work. Before performing any Work in each room or space the District and Contractor shall prepare a detailed initial written inventory of District property remaining therein and condition thereof including equipment and telephone instruments, and each shall retain a copy of the inventory dated and signed by both. In same manner, prior to the District re-occupancy of each such room or space the parties shall again inventory District property therein and all discrepancies between the inventories shall be Contractor's responsibility as specified above.

1.05 JOB CONDITIONS

A. General: Coordinate the Work of all trades and with the District to assure correct sequence, limits, methods, and times of performance. Arrange the Work to impose minimum hardship on operation and use of the facilities. Install protection for existing facilities, contents, and new work against dust, dirt, weather, damage, and vandalism, and maintain and relocate as the Work progresses.

B. Access: Confine entrance and exit operations to access routes designated by the District.

C. Existing Conditions: Intent of Drawings is to indicate existing site and facility conditions with information developed from original construction documents, field surveys, and the District records, and to generally indicate amount and type of demolition and removals required to prepare existing areas for new work.

D. Verification of Conditions: Perform a detailed survey of existing site and building conditions pertaining of the Work before starting Work. Report to the District Inspector discrepancies or conflicts between Drawings and actual conditions in writing for clarification and instructions and do not perform Work where such discrepancies or conflicts occur prior to receipt of the Architect’s instructions.

E. Special Noise Restrictions: Use care to prevent generation of unnecessary noise and keep noise levels to minimum possible. When ordered by the District Inspector, immediately discontinue such methods that produce noise disruptive or harmful to facility functions and occupants, and employ unobjectionable methods. Equip air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with "residential" grade mufflers, and muffle the unloading cycle of compressors. Remove from site any equipment producing objectionable noise as determined by the District Inspector.

F. Shoring and Bracing: Provide supports, shoring, and bracing required to preserve structural integrity and prevent collapse of existing construction that is cut into or altered as a part of the Work.

G. Overloading: Do not overload any part of structures beyond safe carrying capacity by placing of materials, equipment, tools, machinery, or any other item thereon.

H. Building Security: Secure building entrances and exits with locking or other approved method in accordance with the District's instructions.

I. Safeguarding the District Property: Contractor shall assume care, custody, and responsibility for safeguarding all the District's property of every kind, whether fixed or portable, remaining in rooms and spaces vacated and turned over to the Contractor by the District for his exclusive use in performance of the Work until the Work therein or related thereto is completed and the rooms or spaces are reoccupied by the District. Furnish all forms of security and protection necessary to protect the District's property. Regardless of cause, Contractor shall repair or replace all of the District's property under the Contractor's care, custody, and safeguarding that is damaged, injured, missing, lost, or stolen from time each such room or space is turned over the Contractor for the Work until re-occupied by the District, at Contractor's expense and as directed by the District.

1. Covering and Cleaning: Cover and protect surfaces of rooms and spaces turned over for the Work, including the District's property remaining therein, as required to prevent soiling or damage by dust, dirt, water, fumes, or otherwise, and protect other areas where Work is performed in same manner, as deemed adequate by the District. Prior to District's re-occupancy of any such room or space, clean all surfaces including District's property in accordance with General Conditions and other cleaning instructions as may be specified in other Sections.

J. Use of District's Telephones: Do not use nor allow anyone other than District employees to use telephone in rooms and spaces turned over to Contractor for the Work except in the case of a bona fide emergency. Install temporary dial locks on telephone instruments to prevent all unauthorized use, or arrange and pay for temporary removal and reinstallation of instruments. Reimburse to the District all telephone toll charges originating from the telephones in such rooms and spaces except those arising from emergencies or use by District employees.

K. Welding: Conform to following requirements where welding is performed in or on existing facilities.

1. Protection During Welding: Conform to Title 8, CAC. Further protect occupants and the public with portable solid vision barricades around locations where welding is performed plus signs warning against looking at welding without proper eye protection, or equivalent.

2. Fire Extinguishers: Maintain a fully charged UL-labeled minimum 6 pound 40B:C dry chemical fire extinguisher at every location where welding is performed within or on the facilities.

3. Welding Smoke Control: Verify locations of existing smoke detectors. Perform welding operations by methods that produce the minimum feasible smoke and fumes. Furnish portable type smoke collection and ventilating equipment as required to prevent smoke and fume nuisances. Notify District at least 48 hours in advance if temporary deactivation of any smoke detector is required to prevent false alarms from the welding operations. The District's personnel will deactivate detectors only for the time welding is actually in progress.

4. Fire Prevention: Before welding, examine existing construction and backing for all combustible materials and finishes and for conditions where heat conduction in metals may bring adjoining materials to ignition temperature. Use positive fire prevention measures including temporary removal and reinstallation of combustible materials, installation of temporary shields and/or heat sinks, and other necessary means. When actual field conditions are such that positive fire prevention measures cannot be achieved, notify Architect and do not proceed with the involved work until receipt of Architect's instructions.

L. Protection of Floors: Use care to protect all floor surfaces and coverings from damage. Equip mobile equipment with pneumatic tires.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General: When patching existing work in place, use materials that match existing materials in performance, thickness and finish.

PART 3 - EXECUTION

3.01 PROTECTION:

A. Glass: Provide such protection as may be required to prevent glass breakage for all glass to be reused or to remain. At no additional cost, replace in kind all broken glass.

B. Existing Work to Remain: Provide such forms of protection as may be necessary to prevent damage to and dust or dirt contamination of existing work and equipment to remain.

C. Items to be Reused: Exercise the greatest possible care when removing items scheduled for reuse. Use only mechanics skilled in the appropriate trades. Identify point of reuse, store and protect at locations directed.

D. If required due to damage, replace with new materials to match existing in same manner and technique originally utilized.

3.02 REMOVALS, ALTERATIONS, AND REPAIRS:

A. Basic Requirement: Restore and refinish all new and existing construction and improvements that are cut into, altered, damaged, relocated, reinstalled, or left unfinished by removals to original condition or to match adjoining work and finishes unless otherwise shown, specified, directed, or required. Workmanship and materials shall conform to applicable provisions of other Sections. Provide new fasteners, connectors, adhesives, and other accessory materials as required to fully complete approved reinstallations and restorations. Where restorations and refinishing are defective or are otherwise not acceptable to Architect, remove all the defective or rejected materials and provide new acceptable materials and finish at no extra cost to District.

B. Extent: Perform removals to extent required plus such additional removals as are necessary for completion even though not indicated or specified. More or less of the existing construction may be removed if such variation will expedite the work and reduce cost to the District, subject to prior approval in each case.

C. Removals: Carefully remove work to be salvaged or reinstall and store under cover.

3.03 MECHANICAL AND ELECTRICAL:

A. Demolish existing mechanical, plumbing and electrical items as indicated in the Drawings and Specifications.

3.04 REMOVED MATERIAL AND DEBRIS:

A. All removed material, not otherwise designated, and all debris becomes the property of the Contractor who shall remove it from the site and dispose of it in a legal manner.

B. Do not allow materials and debris generated by demolition activities to accumulate. Remove daily.

C. Leave all spaces broom clean with all ledges and corners properly cleaned.

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this and the other sections of Division 22.

B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.

C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 SECTION INCLUDES

A. This Section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Plumbing installations.
   7. Cutting and patching.

1.03 DESCRIPTION

A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications

1.04 DEFINITIONS

A. "Provide" means furnish, install and connect unless otherwise described in specific instances.

B. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.

C. "Ductwork" means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.

D. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.

E. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

F. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.

G. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.

H. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.

I. "Below Grade" means buried in the ground.

J. "Substantial Mechanical Completion" means all components of all systems are functioning but lacking in final adjustment.

K. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

1.05 RELATED WORK

A. Coordination: Refer to Architectural, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of mechanical work in relation to the work of other Divisions.

B. Examine other Divisions for work related to the Work of this Division, especially Electrical.

1.06 EXISTING CONDITIONS

A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.

B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.

C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

1.07 DRAWINGS AND SPECIFICATIONS

A. These drawings and specifications do not include necessary components for construction safety.

B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping and ductwork is to be run. The drawings do not necessarily indicate any and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work of other trades.

1.08 PERMITS AND INSPECTIONS

A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.

B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.09 CODES AND REGULATIONS

A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such

conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.

B. Applicable Codes: (Current editions unless otherwise noted)
   1. All local codes; city and/or county as applicable.
   2. OSHA requirements
   3. California Code of Regulations (CCR) Titles (as applicable)
   4. Fire Marshal Regulations
   5. State, County, City Health Department Ordinances and Regulations
   6. Regulations of all other authorities having jurisdiction.
   7. California Mechanical Code.
   8. California Plumbing Code.

C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.10 SUBMITTALS

A. General: Follow the procedures specified in Division 01.

B. Mechanical Submittals: Increase the number of mechanical related shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.

C. Product Data: Assemble "product data" into tabbed brochures according to main areas of work i.e. Fire Protection; Plumbing; H.V.A.C.; Temperature Control; Testing, Adjusting, and Balancing.
   1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
   2. Temperature "control shop drawings" may be submitted separately after preparations for review.
   3. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
   4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.

D. Submit for review, only the specific items required in this Section or other Sections of Division 22.

E. Additional submittals shall include, but not limited:
   1. Air balance reports and equipment data record drawings.
   2. Certification of completion of testing.
   3. Certification of completion of operation instructions.
   4. Operating instruction brochure.
   5. Maintenance instruction brochures.
   6. Equipment guarantees.
   7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
   8. Coordination Drawings, where requested or required.

F. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.

G. Additional copies may be required by individual sections of these specifications.

1.11 COORDINATION

A. The Contractor shall be responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.

B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

C. Contractor shall designate an individual competent and versed in the mechanical trades to coordinate the mechanical work with the work of other trades.

1.12 COORDINATION OF DRAWINGS

A. Prepare coordination drawings in accordance with Division 01 to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
   1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
      a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      b. Equipment for connections and support details.
   2. Prepare reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

B. Submittal of "Or Approved Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

1.13 RECORD AND DOCUMENTATION

A. Prepare record documents in accordance with the requirements in Division 01. In addition to the requirements specified in Division 01, indicate the following installed conditions:
   1. Record as specified in Division 01 the locations and invert elevations of underground installations.
   2. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
   3. Record (As-Built) Drawings:
      a. Maintain in good order in the field office a complete set of prints for all work being done under Division 15. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
      b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stub-outs shall be accurately located and dimensioned from building walls or other permanent landmarks.
      c. Furnish the originals.
   4. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated mechanical systems and equipment. Seven copies of the manual, bound in hardback binders or an approved equivalent shall be provided to the Architect.
   5. Furnish one complete manual prior to the time that system or equipment tests are performed.
   6. Furnish the remaining manuals before the contract is completed.
   7. The following identification shall be inscribed on the cover:
      OPERATION AND MAINTENANCE MANUAL
      PROJECT TITLE . . . . . .
      CONTRACTOR
   8. Provide a table of contents. Insert tab sheets to identify discrete subjects. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in. The manual

shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:

a. Updated approved materials lists, shop drawings and catalog information of all items of mechanical system equipment.
b. System layout showing piping, valves and controls.
c. Wiring and control diagrams with data to explain detailed operation and control of each component.
d. A control sequence describing start-up, operation and shutdown.
e. Detailed description of the function of each principal component of the system.
f. Procedure for starting.
g. Procedure for operating.
h. Shut-down instructions.
i. Installation instructions.
j. Adjustments, maintenance and overhaul instructions.
k. Lubrication schedule including type, grade, temperature range and frequency.
I. Safety precautions, diagrams and illustrations.
m. Test procedures.
n. Performance data.
o. Parts list, with manufacturer's names and catalog numbers.
p. Preventive maintenance schedule.
q. Service organization with name, address and telephone number.
r. Valve identification chart and schedule.
s. ASME certificates.
t. Air balance report.
u. Hydronic balance report.

B. Standards Compliance: Where equipment or materials are specified to conform with requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Refrigeration Institute (ARI}, or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.

C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.

D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.

E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.

F. Permits and Certificates of Inspection: Furnish the originals.

G. Testing procedures and test results required in this and other sections. Furnish 2 copies.

H. Other data required by other sections of this Division. Furnish 2 copies.

1.14 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 01.

1.15 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

1.16 EQUIVALENT EQUIPMENT

A. These specifications and/or drawings names and specifies certain equipment in detail. It also names equivalent equipment by manufacturer, which is not considered to be a "substitution".

B. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Basic Mechanical Requirements."

C. Equipment of Manufacturers named in Division 22 will be considered equivalent to that specified in detail and/or named on the drawings if:
   1. The proposed equipment is of equivalent quality, capacity.
   2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar to the equipment specified in detail.

D. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.

E. The Architect shall determine the acceptability of "Equivalent Equipment."

1.17 CONSTRUCTION COST BREAK DOWN

A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the mechanical work in accordance with General and Supplemental Conditions and Division 1.

B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.

C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

1.18 TOOLS

A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.19 WARRANTIES

A. Refer to Division 1 Section for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume running for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.

C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.

D. Compile and assemble the warranties specified in Division 15, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.20 SEISMIC RESTRAINT

A. Provide seismic restraint for mechanical equipment, piping, and ductwork.

B. Contractor shall submit certification of suitability of seismic restraint methods signed by Structural Engineer registered in State of California.

C. Contractor may refer to details applicable in the SMACNA, "GUIDELINES FOR SEISMIC RESTRAINT OF MECHANICAL SYSTEMS", using the 'g' forces for "other buildings" classification CCR Title 24. Deliver a copy of these Guidelines to the Owner's Resident Inspector.

1.21 SYSTEM OPERATIONAL TEST

A. The Contractor shall inform the Owner in writing one week prior to starting this testing in order that the Owner's representative may be present.

B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen (14) consecutive days including Saturday and Sunday. Each day shall be a minimum of an 8-hour day. Should a problem arise, the fourteen (14) day period shall be restarted and repeated until successfully operated for full14 days. A written report certified by the Owner's representative shall indicate the successful completion of a stable and trouble free 14-day period.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.

B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening, unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.

C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

D. Whenever on the plans, or in these specifications, products are identified by the name of one manufacturer, it is intended that equivalent products of other manufacturers are acceptable, unless otherwise indicated, if accepted as a substitution by the Architect.

E. Where three or more manufacturers are listed as "acceptable manufacturers" however, then the products furnished shall be the product of one of the manufacturers listed. Manufacturers listed as "acceptable manufacturers" shall be considered "Equivalents" and shall meet quality and performance of a particular one specified by both name and catalog number.

2.02 PRODUCT LISTING

A. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and

grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in Work, except as otherwise indicated.

2.03 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated mechanical equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.04 SUBSTITUTIONS

A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 1. B. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any changes (whether architectural, structural, electrical or mechanical) necessary to accommodate the substitution, if said substitution is accepted.

C. Specific: Refer to other sections of this Division for additional requirements.

2.05 SUBMITTALS

A. General: Make submittals in accordance with requirements of Division 1.

B. Specific: Refer to other sections of this Division for additional requirements. PART 3 EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

A. Workmanship shall be in the best standard practice of the trade.

B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TEST

A. General:
1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.

B. Specific: Refer to the other sections of this Division for test requirements.

3.03 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 02 through 23 for rough-in requirements.

3.04 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.
2. Verify all dimensions by field measurements.
3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.
4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for

efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
7. Coordinate connection of mechanical system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
10. All mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors, in sizes large enough to allow adequate access for testing and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component which is serviceable shall be installed within12" of the top of the ceiling, and so that all components are accessible.

3.05 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 01. In addition to the requirements specified in Division 01, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.
2. Remove and replace defective work.
3. Remove and replace Work not conforming to requirements of the Contract Documents.
4. Remove samples of installed Work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the Architect, uncover and restore Work to provide for

Architect/Engineer/Inspector observation of concealed Work.

C. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim, and other mechanical items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

F. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

3.06 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

A. Protect materials against dirt, water, chemical and mechanical damage both while in storage and during construction.

B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.

C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.

D. Keep cabinets and other openings closed to prevent entry of foreign matter.

E. Specific: Refer to other sections of this Division for additional requirements.

3.07 PROJECT CONDITIONS

A. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.

B. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Mechanical Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

3.08 INSTRUCTION TO OWNER PERSONNEL

A. When specified in other sections, the Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B. Contractor shall electronically record, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the mechanical systems.

C. Submit certification, signed by Owner's agent that instructions have been completed and the electronic record has been reviewed and delivered to the Owner.

D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment guarantee and maintenance instructions.

3.09 CLEANING

A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.

B. Refer to the Division 01 Sections for general requirements for final cleaning.

C. Leave exposed parts of the mechanical work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Architect and District Representative.

E. Remove, thoroughly clean and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

3.10 SAFETY REQUIREMENTS

A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high- temperature equipment and piping so located as to endanger personnel or create a fire hazard.

END OF
SECTION

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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, consult utility owner immediately for directions. Cooperate with

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:	12" +pipe O.D. for 4" to 18" diameter pipe
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

1.01 SECTION INCLUDES

A. This Section includes the following types of meters and gages:
   1. Temperature gages and fittings.
   2. Pressure gages and fittings.
   3. Flow meters.

B. Meters and gages furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.02 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 01 Specification Sections and Section 22 05 00 "Common Work Result for Plumbing".
   1. Product data for each type of meter and gage. Include scale range, ratings. Submit meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.
   2. Maintenance data for each type of meter and gage for inclusion in Operating and Maintenance Manuals specified in Division 01 and Division 22 Section "Common Work Results for Plumbing".

1.03 QUALITY ASSURANCE

A. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mercury-In-Glass Thermometers:
      a. Marshalltown Instruments, Inc.
      b. Trerice (H.O.) Co.
      c. Weiss Instruments, Inc.
      d. Weksler Instruments Corp.
   2. Thermometer Wells: Same as for thermometers.
   3. Pressure Gages:
      a. Ametek, U.S. Gauge Div.
      b. Ashcroft Dresser Industries Instrument Div.
      c. Marsh Instruments Co., Unit of General Signal.
      d. Marshalltown Instruments, Inc.
      e. Trerice (H.O.) Co.
      f. Weiss Instruments, Inc.
      g. Weksler Instruments Corp.
      h. WIKA Instruments Corp.
   4. Pressure Gage Accessories: Same as for pressure gages.
   5. Water Orifice-Type Measurement System:
      a. Armstrong Pumps, Inc.

b. Bell & Gossett, ITT. Fluid Handling Div.

6. Calibrated Balance Valves
   a. Armstrong Pumps, Inc.

b. Bell and Gossett, ITT, Fluid Handling Div.

7. Venturi-Type Flow Measurement System a. Armstrong Pumps, Inc.
   b. Barco Div., Marison Industries c. Gerand Engineering Co.
8. Test Plugs
   a. MG Piping Products Co.
   b. Peterson Equipment Co., Inc. c. Sisco, A Spedco, Inc. Co.
   d. Trerice (H.O.) Co.
   e. Watts Regulator Co.

2.02 THERMOMETERS, GENERAL

A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

B. Scale range: Temperature ranges for services listed as follows:
   1. Domestic Hot Water: 30 to 240 deg F with 2-degree scale divisions.
   2. Domestic Cold Water: 0 to 100 deg F with 2-degree scale divisions
   3. Heating Water: 30 to 300 deg F with 2-degree scale divisions
   4. Condenser Water: 0 to 160 deg F with 2-degree scale divisions
   5. Chilled Water: 0 to 100 deg F with 2-degree scale divisions
   6. Steam and Condensate: 50 to 400 Deg F with 2-degree scale divisions

2.03 MERCURY-IN-GLASS THERMOMETERS

A. Case: Die cast, aluminum finished, in baked epoxy enamel, glass front, spring secured, 9 inches long.

B. Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

C. Tube: Red reading, mercury filled, magnifying lens.

D. Scale: Satin-faced, non-reflective aluminum, with permanently etched markings.

E. Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

2.04 THERMOMETER WELLS

A. Thermometer Wells: Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

2.05 PRESSURE GAGES

A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection.

B. Case: Drawn steel or brass, glass lens, 4-1/2-

inches diameter. C. Connector: Brass, 1/4-inch NPS.

D. Scale: White coated aluminum, with permanently etched markings.

E. Accuracy: Plus or minus 1 percent of

range span. F. Range: Conform to the

following:

1. Vacuum: 30" & 0-15 psi compound range; 1" and 1/2 psi graduations.
2. Chilled and heating water systems, except as otherwise indicated: 0-60 psi range, 1 psi graduation.

3. Condenser water system, except as otherwise indicated: (0-15); (0-30) psi range, (1/4 psi); (1/2 psi) graduation.
4. Except as otherwise indicated: 0-100 psi range, 1 psi graduation.
5. High temperature water system: 0-300 psi range, 2 psi graduations.

2.06 PRESSURE GAGE ACCESSORIES

A. Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

B. Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

2.07 FLOW METERS, GENERAL

A. Flow rate of elements and meters shall be same as connected equipment or system.

2.08 WAFER ORIFICE-TYPE FLOW ELEMENTS

A. Type: Differential-pressure wafer type orifice insert flow elements designed for installation between pipe flanges.

B. Construction: Cast-iron body, brass valves with integral check readout valves and caps, and calibrated nameplate. Elements pressure rated for 300 psig and 250 degree F.

2.09 CALIBRATED BALANCE VALVE

A. Type: Differential-pressure, ball type, adjustable orifice designed for installation in piping.

B. Construction: Bronze body/brass ball construction with glass and carbon filled TFE seal rings, screwed connections with integral check readout valves and caps and calibrated nameplate and memory stop and drain connection. Elements pressure rated for 300 psig and 250 degree f.

2.10 VENTURI-TYPE FLOW ELEMENTS

A. Type: Differential-pressure venture-type, designed for installation in piping.

B. Construction: Bronze or cadmium-plated steel with brass fittings and attached tag with flow conversion data. Ends shall be threaded for 2 inches and smaller elements and flanged or welded for 2-1/2 inches and larger elements.

2.11 PITOT TUBE-TYPE FLOW ELEMENTS

A. Type: Differential-pressure pitot-tube type design with probe for insertion into piping.

B. Construction: Stainless steel probe of length to span inside of pipe, with brass fittings and attached tag with flow conversion data. Elements shall be pressure rated for 150 psig and 250°F (120°C).

2.12 METERS

A. Portable Meters: Differential-pressure gage and two 12-foot hoses in carrying case with handle.

B. Scale: In inches of water unless otherwise indicated.

C. Accuracy: Plus or minus 2 percent between 20 to 80 percent of range.

D. Each meter shall be complete with operating instructions.

2.13 TEST PLUGS

A. Test Plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and 2 self-sealing valve-type core inserts, suitable for inserting a 1/8-inch O.D. probe assembly from a dial-type thermometer or pressure gage. Test plug shall have gasket and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

B. Core Material: conform to the following for fluids and temperature range:

C. Air, Water, Oil, and Gas, 20 to 200° F: Neoprene.

D. Test Kit: Provide test kit consisting of 1 pressure gage, gage adapter with probe, 2 bimetal dial thermometers, and carrying case.

E. Ranges of pressure gage and thermometers shall be approximately 2 times systems operating conditions.

PART 3 EXECUTION

3.01 THERMOMETERS INSTALLATION

A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

B. Install in the following locations and elsewhere as indicated:
1. At inlet and outlet of each hydronic zone.
2. At inlet and outlet of each hydronic boiler and chiller.
3. At inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At inlet and outlet of each thermal storage tank.

C. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.02 INSTALLATION OF PRESSURE GAGES

A. Install pressure gages in piping tee with pressure gage valve, located on pipe at most readable position.

B. Install in the following locations, and elsewhere as indicated:
1. At suction and discharge of each pump.
2. At discharge of each pressure-reducing valve.
3. At building water service entrance.
4. At chilled water and condenser water inlets and outlets of chillers.

C. Pressure Gage Needle Valves: Install in piping tee with snubber. Install syphon in lieu of snubber for steam pressure gages.

3.03 INSTALLATION OF TEST PLUGS

A. Test Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.04 INSTALLATION OF FLOW-MEASURING ELEMENTS AND METERS

A. Locations: Install flow measuring elements in the following locations and elsewhere as indicated.
1. At discharge of each pump.
2. At inlet of each hydronic coil in built-up central systems.

B. Differential-Pressure-Type Flow Elements: Install minimum straight lengths of pipe upstream and downstream from element as described by the manufacturer's installation instructions.

C. Install wafer orifice-type element between 2 Class 125 pipe flanges, ANSI B16.1 (cast iron) or ANSI B16.24 (bronze).

D. Install connections for attachments to portable flow meters in a readily accessible location.

3.05 INSTALLATION OF CALIBRATED BALANCE VALVES

A. Install calibrated balance valves in the following locations and elsewhere as indicated.
   1. At each fan coil unit.
   2. At each unitary water source heat-pump.
   3. At each 3-way valve.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.07 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

B. Install meters and gages piping adjacent to machine to allow servicing and maintaining of machine.

END OF
SECTION

NOTE: PLUMBERS TO REVIEW TYPES OF VALVES FOR INCLUSION IN MATERIALS

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.

1.02 SECTION INCLUDES

A. This Section includes general duty valves common to most mechanical piping systems.
   1. Special purpose valves are specified in individual piping system specifications.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Section 22 05 00 "Common Work Results for Plumbing."
   1. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
   2. Provide valve schedule showing manufacturer's figure numbers and sizes.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Comply with the requirements specified in Division 01 Section "Materials and Equipment," under "Source Limitations."

B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves for shipping as follows:
   1. Ensure valves are dry and internally protected against rust and corrosion.
   2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
   3. Set valves in best position for handling. Set globe and gate valves closed to prevent ratting; set ball and plug valves open to minimize exposure of functional surfaces; and block swing check valves in either closed or open position.

B. Storage: Use the following precautions during storage:
   1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

2.02 VALVE FEATURES, GENERAL

A. Valve Design: Rising stem or rising outside screw and yoke stems.
1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated. D. Operators: Provide the following special operator features:

1. Hand wheels, fastened to valve stem, for valves other than quarter turn.
2. Lever handles, on quarter-turn valves 6-inches and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
3. Chain-wheel operators, for valves 2-1/2 inch and larger, install 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation. a. Provide gear drive operators, on quarter-turn valves 8-inch and larger.

E. Extended Stems: Where insulation is indicated or specified provide extended stems arranged to receive insulation.

F. End Connections: As indicated in the valve specifications.

1. Threads: Comply with ANSI B1.20.1.
2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
3. Solder-Joint: Comply with ANSI B16.18.
   a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. F for gate, globe, and check valves; below 421 deg. F for ball valves.

2.03 GATE VALVES

A. Gate Valves, 2-lnch and Smaller: MSS SP:..80; Class 150, body and union bonnet of ASTM B62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron hand wheel. Do not use solder end valves for hot water heating or steam piping applications.

MANUFACTURER	THREADED NRS	THREADED RS	SOLDER NRS	SOLDERRS
Crane	X	431UB	X	X
Grinnell	3050	3060	X	X
Milwaukee	1141	1151	X	1169
Nibco	T-136	T-135	S-136	X
KITZ	X	42	X	43

"X" means not available.

B. Gate Valves, 2-1/2 Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A126 class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

MANUFACTURER	OS&YRS	NRS
Crane	465-1/2	461
Grinnell	6020A	6060A

Nibco	617-0	F-619
Milwaukee	F-2885	F-2882
KITZ	72	75

2.04 BALL VALVES

A. Ball Valves, 2 Inches and Smaller: Rated for 150 psi saturated stem pressure, 400 psi WOG pressure; two- or three-piece construction; with bronze body conforming to ASTM B 62, full port only, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

Ball Valves - 1 Inch and Smaller:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	70-100	70-200
Crane	9302	9322
Nibco	T-580-70	S-580-70
Stockham	S-216 BR-R-T	S-216-BR-R-S
Watts	B-6000	B-6001
Milwaukee	BA-100	BA-150
KITZ	58	59

"X" means not available.

Ball Valves- 1-1/4 Inch to 2 Inch:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Conbraco (Apollo)	82-100	82-200
Nibco	T-590-Y	S-590-Y
Stockham	S-216 BR-R-T	S-216-BR-R-S
Watts	B-6800	B-6801
KITZ	62	63

"X" means not ava1lable.

B. For grooved end connections, use Victaulic Style 721.

2.05 PLUG VALVES

A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG; bronze body, with straightaway pattern, square head, and threaded ends.
   1. Lunkenheimer: 454 or equal.
   2. Homestead: 611 (Semi Steel Body) or equal.

B. Plug Valves, 2-1/2 Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semi steel body, single gland, wrench operated and flanged ends.
   1. Powell: 2201 or equal.
   2. Homestead: 605 or equal.

2.06 GLOBE VALVES

A. Globe Valves, 2-Inch and Smaller: MSS SP-80; Class 125; body and screwed bonnet of ASTM B
62 cast bronze; with threaded or solder ends, brass or replaceable composition disc, copper- silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron hand wheel. Provide Class 150 valves meeting the above where system pressure requires.

CLASS 125 MANUFACTURER	CLASS 125 THREADED	CLASS 150 SOLDER	THREADED
Crane	1	1310	17TF
Milwaukee	502	1502	590
Nibco	T-211-B T-	S-211-B S-	T-235-Y
KITZ	11	12	10

B. Globe Valves, 2-1/2-Inch and Larger: MSS SP-85; Class 125 iron body and bolted bonnet conforming to ASTM A 126, Class B; with outside screw and yoke, bronze mounted, flanged ends, and "Teflon" impregnated packing, and two-piece backing gland assembly.

MANUFACTURER	STRAIGHT BODY	ANGLE BODY
Crane	351	353
Milwaukee	F2981	F2986
Nibco	F-718-B	F-818-B
KITZ	76	X

2.07 BUTTERFLY VALVES

"x" means not available.

A. General - Where butterfly valves are used as shutoff for termination, or equipment removal or repair, select ductile iron lug type valves, bi-directional, dead-end service rated to the full working pressure of the valve. Select wafer type valves for other applications. Provide gear operators on butterfly valves 8" and larger. Valve bodies to have extended necks to provide for 2-1/4" insulation as needed. Butterfly valves 12 inch and smaller rated to 200 psi, 14 inch and larger 150 psi.

Butterfly Valves 2-1/2 Inches and Larger:

The following are model numbers for wafer-type, with nickel-plated ductile-iron disc:

MANUFACTURER	LEVER	GEAR
Crane	12	12
Nibco	WD-20103	WD-20105
Milwaukee	MW-222E	MW-322E
KITZ	DJ Series	DJ Series

Grooved Ends: Victaulic Style 300 and 704.

The following are model numbers for lug-type, with nickel-plated ductile-iron disc:

MANUFACTURER	LEVER	GEAR
Crane	14	14
Nibco	LD-20103	LD-20105
Milwaukee	ML-222E	ML-322E
KITZ	DJ Series	DJ Series

Grooved Ends: Victaulic Style 300 and 704.

The following are model numbers for wafer-type, with aluminum-bronze disc:

MANUFACTURER	LEVER	GEAR
Crane	42	42
Nibco	WD-20003	WD-20005
Milwaukee	CW-223E	CW-323E
KITZ	DJ Series	DJ Series

Grooved Ends: Vic taulic Style 300A, 700A, and 703A.

The following are model numbers for lug-type, with aluminum-bronze disc:

MANUFACTURER	LEVER	GEAR
Center Line	Series LT	Series LT
Crane	44	44
Nibco	LD-20003	LD-20005
Milwaukee	CL-223E	CL-323E
KITZ	DJ Series	DJ Series

Grooved Ends: Victaulic Style 300A, 700A, and 703A.

2.08 CHECK VALVES

A. Swing Check Valves, 2-lnch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

MANUFACTURER	CLASS 125 THREADED ENDS	CLASS 125 SOLDER ENDS	CLASS 125 THREADED ENDS
Crane	37	1342	137
Milwaukee	509	1509	510
Nibco	T-413	S-413	T-433
KITZ	22	23	29

For grooved connections, use Victaulic Style 712.

B. Swing Check Valves, 2-1/2 Inch and Larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal wing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Crane	373	X
Milwaukee	F2974	X
Nibco	F-918	X
KITZ	78	X

For grooved connections, use Victaulic Series 712. "X" means not available.

C. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL	ANGLE
Jenkins	655-A	X
Lunkenheimer	233	X

"X" means not available.

PART 3
EXECUTION

3.01 EXAMINATION

A. Examine valve interior through the end ports 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. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

3.02 VALVE ENDS SELECTION

A. Select valves with the following ends or types of pipe/tube connections:
1. Copper Tube Size, 2-Inch and Smaller:Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
3. Steel Pipe Sizes 2-1/2 Inch and Larger: grooved end or flanged.

3.03 VALVE INSTALLATIONS

A. General Application: Refer to piping system specification sections for specific valve applications and arrangements. Use gate, ball, and butterfly valves for shut-off duty. Use globe, plug, and ball valves for throttling duty.

B. Locate valves for easy access and provide separate support where necessary. Where concealed, install behind access panel with valve located for complete accessibility for servicing.

C. Install valves and unions for each fixture and item of equipment. Arrange valves to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.

E. Install valves in horizontal piping with stem at or above the center of the pipe. F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:
1. Swing Check Valves: Horizontal position with hinge pin level.
2. Lift Check Valve: With stem upright and plumb.

H. Where shut-off valves are installed in a confined space such as in a wall or furring, install ball valves with operating handle parallel with face of wall.

I. Where valves are located in walls, do not install more than 6'-0" from finished floor. Where valves are located above ceiling, install valve centered on access point and not greater than 24" above access point.

3.04 SOLDER CONNECTIONS

A. Cut tube square and to exact lengths, and ream tube and remove burrs to restore full inside diameter of tube/pipe.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube. D. Open gate and globe valves to full open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

H. Use 95-5 tin/antimony solder for all solder joints unless indicated otherwise.

3.05 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.06 FLANGED

CONNECTIONS A. Align

flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.07 FIELD QUALITY CONTROL

A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.08 ADJUSTING AND CLEANING

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.09 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

A. Below schedules are for standard installation conditions. Variations or special valves and/or conditions set forth in other Division 22 Sections shall take precedence.

VALVES. 2-INCH AND SMALLER

SERVICE	GATE	GLOBE	BALL	CHECK
Condenser Water	125	125	150	125
Chilled Water	125	125	150	125
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150
Low-Pressure Steam	150	150	150	150

VALVES. 2-1/21NCH AND LARGER

SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
Condenser	125	125	200	125
Chilled Water	125	125	200	125
Domestic Hot and Cold Water	125	125	200	125
Heating Hot Water	125	125	200	125
Low-Pressure Steam	125	125	200	125

END OF
SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART1 GENERAL

1.01 SECTION INCLUDES

A. Extent of supports and anchors required by this section is indicated on drawings or in other Division-22 sections and include the following:

1. Horizontal-Piping Hangers and Supports;
2. Vertical-Piping Clamps;
3. Hanger-Rod Attachments;
4. Building Attachments;
5. Saddles and Shields;
6. Miscellaneous Materials;
7. Anchors;
8. Equipment Supports.

1.02 RELATED SECTIONS

A. This section is part of each Division-22 section making reference to or requiring supports and anchors specified herein.

B. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-22 sections.

C. Section: Cast-in-Place Concrete.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are UL-Iisted and FM approved.
3. MSS Standard Compliance:
   a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
   b. Select and apply pipe hangers and supports, complying with MSS SP-69.

c. Fabricate and install pipe hangers and supports, complying with MSS SP-89. d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITIALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
   1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal Hanger Shield Inserts: 100-psi average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.02 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
   1. Adjustable Steel Clevis Hangers: MSS Type 1.
   2. Adjustable Swivel Pipe Rings: MSS Type 6.

2.03 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.04 HANGER-ROD AND BUILDING ATTACHMENTS

A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
   3. Concrete Inserts: MSS Type 18.
   4. Center Beam Clamps: MSS Type 21.
   5. Steel Beam Clamps W/Eye Nut: MS Type 28.
   6. Linked Steel Clamps W/Eye Nut: MSS Type 29.
   7. Malleable Beam Clamps: MSS Type 30.
   8. Steel Brackets: One of the following for indicated loading:
   9. Light Duty: MSS Type 31.

2.05 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
   1. B-Line Systems, Inc.
   2. Talco, Inc.
   3. Eleen Metal Products Co.
   4. Fee & Mason Mfg. Co.; Div. Figgie International.
   5. ITT Grinnel Corp.

2.07 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes and Bars: ASTM A36.

B. Cement Grout: Portland cement (ASTM C150, Type I or Type Ill) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

C. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

2.08 ISOLATORS

A. Isolators: Provide factory-fabricated isolators of size required.

B. Spring Isolators: Refer to Section 23 05 48 Vibration and Seismic Control for HVAC.

C. Manufacturers: Refer to Section 23 05 48 Vibration and Seismic Control for HVAC.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachment.

B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction

of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and type as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

D. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.

E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.

H. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any}, to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.

I. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

3.05 EQUIPMENT SUPPORTS

A. Concrete housekeeping bases will be provided as work of Division 0 3.

B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.06 ADJUSTING AND CLEANING

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds 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 touch-up of field-painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

E. For 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 07 00

PLUMBING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extent of mechanical insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
   1. Piping Systems Insulation:
      a. Fiberglass.
      b. Calcium Silicate.
      c. Flexible Unicellular.
   2. Equipment Insulation:
      a. Fiberglass
      b. Calcium Silicate
      c. Flexible Unicellular.
   3. Acoustical Insulation
      a. Fiberglass

1.02 RELATED SECTIONS

A. Refer to Division-22 section 22 05 29 for protection saddles, protection shields, and thermal hanger shields; not work of this section.

B. Refer to Division-22 section 22 05 53 for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

B. As a minimum, insulation shall meet installed thermo (R) value as set forth in Title 24 California Code of Regulations (CCR) Part 6 Section 123, 124; and Part 4 Section 605.0, or as indicated in contract documents, whichever is greater.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Armstrong World Industries, Inc.
2. Babcock and Wilcox; Insulating Products Div.
3. Certainteed Corp.
4. Knauf Fiber Glass GmbH.
5. Manville Products Corp.
6. Owens-Corning Fiberglas Corp.
7. Pittsburgh Corning Corp.
8. Rubatex Corp.

2.02 PIPING INSULATION MATERIALS

A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-11 or equivalent.

B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.

C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. or Rubatex Corp. meeting ASTM E-84 25/50 index.

D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
   1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
   2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.

E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

G. All Insulation shall be U.L. listed showing flame spread not greater that 25, nor smoke greater than 50, per NFPA 90A.

2.03 EQUIPMENT INSULATION MATERIALS

A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.

B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.

C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.

F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.04 ACOUSTICAL INSULATION

A. Rigid Fiberglass Insulation: ASTM C612, Class 1, Owens/Corning Fiberglass, Inc., 10 Lbs/ft3.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PLUMBING PIPING SYSTEM INSULATION:

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre- insulated equipment.

B. Cold Piping:
   1. Application requirements: Insulate the following cold plumbing piping systems:
      a. Potable chilled water piping.
      b. Plumbing drains carrying cold condensate.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 1" thickness.
      b. Flexible Unicellular: 1/2" thickness.

C. Hot Piping:
   1. Application Requirements: Insulate the following hot plumbing piping systems.
      a. Potable hot water piping.
      b. Potable hot water re-circulating piping.
      c. Hot drain piping (where indicated).
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
      a. Fiberglass: 1" thick for pipe sizes up to and including 6", 1-112" thick for pipe sizes over 6".

3.03 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):
   1. Application requirements: Insulate the following cold equipment:
      a. Refrigeration equipment, including chillers, tanks and pumps.
      b. Drip pans under chilled equipment.
      c. Cold and chilled water pumps.
      d. Pneumatic water tanks:
   2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 2" thick for cold surfaces above 35°F and 3" thick for surfaces 35°F and lower.

B. Hot Equipment (Above Ambient Temperature):
   1. Application Requirements: Insulate the following hot equipment:
      a. Boilers (not pre-insulated at factory).
      b. Water heaters.
      c. Hot water expansion tanks.
      d. Hot water pumps.
   2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
      a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.

C. Breaching and Stacks:

1. Application Requirements: Insulate the following breechings and stacks:
   a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

3.04 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulated each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.05 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

H. Do not insulate hot water storage tank manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.06 ACOUSTICAL INSTALLATION

A. Install within confines of roof curbs for roof mounted air handlers and air conditioning units, and elsewhere as indicated on drawings

B. Cut to fit snugly within curb and around duct at duct penetrations, 4" minimum thickness.

3.07 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART1 GENERAL

1.01 SECTION INCLUDES

A. Extent of mechanical identification work required by this section is indicated on drawings or specified in other Division-22 sections, and includes the following:
   1. Painted Identification Materials
   2. Plastic Pipe Markers
   3. Plastic Tape
   4. Underground-Type Plastic Line Marker
   5. Plastic Duct Markers
   6. Valve Tags
   7. Diagram and Schedule Frames
   8. Engraved Plastic-Laminate Signs
   9. Plastic Equipment Markers
   10. Plasticized Tags
   11. Equipment Marker

1.02 RELATED SECTIONS

A. This section makes reference to identification devices specified herein.

B. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division-22 sections.

C. Refer to Division-26 Sections for identification requirements of electrical work; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules and Diagrams:
   1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
   2. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.

D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 22, Section 22 05 00.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors,

and viewing angles of identification devices.

2. No adhesive type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   1. Allen Systems, Inc.
   2. Brady (W.H.) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-22 sections. Where more than a single type is specified for application, selection is Installer's option, but provide a single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on un-insulated pipes subject to fluid temperatures of 125oF (52oC) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Laminated or bonded application of pipe marker to pipe (or insulation).
   3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
   1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.04 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 UNDERGROUND-TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.06 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high and with 5/32" hole for fastener.
   1. Provide 1-1/2" diameter tags, except as otherwise indicated.
   2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.07 DIAGRAM AND SCHEDULE FRAMES

A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.08 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate in locations approved by the District Representative.

2.09 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No.3, Air Supply No. 1H, Standpipe F12).

2.10 EQUIPMENT MARKERS

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
   a. Manufacturer, product name, model number, and serial number.
   b. Capacity, operating and power characteristics, and essential data.
   c. Labels of tested compliances.
2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
2. Data.
3. Name and plan number.
   a. Equipment service.
   b. Design capacity.
   c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
4. Size: 2 1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
1. Data: Instructions for operation of equipment and for safety procedures.
2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Retain and edit subparagraph above or first subparagraph below.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.11 PLASTIC DUCT MARKERS

A. Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.

1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
4. At access doors, manholes similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.03 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

3.04 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve on valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by ArchitecUEngineer.

3.05 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Mechanically affix signs or markers on equipment with non-corroding fasteners on four sides if square or rectangular, or three points if round. If affixing to equipment may damage the unit, then affixing to an adjacent permanent hard surface as approved by the District Representative is acceptable. Provide signs for the following general categories of equipment and operational devices:
   1. Fuel-burning units including boilers, furnaces, heaters.
   2. Pumps, compressors, chillers, condensers and similar motor-driven units.
   3. Fans and blowers.
   4. Packaged HVAC central-station or zone-type units.
   5. Split air conditioner indoor and outdoor units
   6. Single Duct terminal units and all equipment in ceiling space.

   (In addition to the equipment tag, install an identification tag for VAV units in locations approved by architect to indicate where each unit is installed above the ceiling. Coordinate the Installation location, type, size and color of this tag with the architect.)

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

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 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. 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

1.01 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.

1.02 SECTION INCLUDES

A. This Section specifies piping specialties and installation methods common to more than one section of Division 22.

1.03 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

1.04 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

2.01 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.

2.02 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.

2.03 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.

2.04 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

3.01 ESCUTCHEONS

A. Install escutcheons at all exposed penetrations of piping through walls, ceilings, and floors in rooms with finish surfaces.

3.02 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	W.H.A. No.
3/4"	5010
1"	5010
1-1/4"	5030
1-1/2"	5040
2"	5050

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. 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.

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

NOTE: PLUMBERS TO REVIEW THIS SECTION FOR FIXTURE TYPES/CATALOG NUMBERS OF CURRENT PRODUCTS

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 2010, Title 24, Part 2 for Accessibility Requirements.
   a. Accessible plumbing fixtures for adults; dimensions shall comply with the requirements of CCR, T-24, Section 1115. B.
   b. Heights and location of fixtures shall be according to CCR, T-24, Chapter 11-B and Table 1115B-1.
   c. Fixture Controls shall comply with CCR, T-24 section 1118 B.
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 California Building Code "CBC" Section 115B and Section 1118B 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.

3.05 INSTALLATION OF ROOF DRAINS

A. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.

B. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

C. Position roof drains so that they are accessible and easy to maintain.

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 03 01 30 - MAINTENANCE OF CAST-IN-PLACE CONCRETE

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. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.
5. Polymer overlays.
6. Polymer sealers.
7. Steel structural reinforcement.
8. Composite structural reinforcement.

B. Related Sections include the following:

1. Section 03 10 00 - Concrete Forms and Accessories
2. Section 03 30 00 - Cast-in-place Concrete
3. Section 07 19 00 - Water Repellents

1.3 UNIT PRICES

A. Unit prices include the cost of preparing existing construction to receive the work indicated and costs of field quality-control testing required by the Work for which the unit price applies.

B. Concrete Removal and Replacement or Patching: Work will be paid for by the cubic foot computed on the basis of rectangular solid shapes approximating the actual shape of concrete removed and replaced with average depths, widths, and lengths, measured to the nearest inch.

1. Reinforcing bar replacement will be paid for separately by the pound of replacement steel with welded and mechanical splices paid for by the unit.

C. Epoxy Crack Injection: Work will be paid for by the linear foot of crack injected.

D. Polymer Overlays: Work will be paid for by the square foot of exposed overlay surface.

E. Composite Structural Reinforcement: Work will be paid for by the square foot of composite material applied.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. Formwork Drawings: Prepared by or under the supervision of a qualified professional engineer detailing formwork. Include schedule and sequence for erection and removal relative to removal of deteriorated concrete and reinforcement and subsequent repair and reinforcement.

C. Samples: Cured Samples of overlay and patching materials.

D. Qualification Data: For installers and manufacturers.

1. For products required to be installed by workers approved by product manufacturers, include letters of acceptance by product manufacturers certifying that installers are approved to apply their products.

E. Material Certificates: For each type of product indicated, signed by manufacturers.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for bonding agents, patching mortars, epoxy adhesives and composite structural reinforcement.

G. Rehabilitation Program: For each phase of rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request complying with Section 01 60 00 Product Requirements and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer that employ workers trained and approved by manufacturer to apply corrosion-inhibiting treatments, concrete patching and rebuilding materials, epoxy crack injection materials, polymer overlays, polymer sealers, and composite structural reinforcement.

B. Manufacturer Qualifications: Manufacturer that employs factory-trained representatives who are available for consultation and Project-site inspection.

C. Source Limitations: Obtain concrete patching and rebuilding materials, epoxy crack injection materials, and composite structural reinforcement materials through one source from a single manufacturer.

D. Mockups: Build mockups for concrete removal and patching, floor joint repair, epoxy crack injection, polymer overlays, polymer sealers and composite structural reinforcement to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 Project Management and Coordination.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

C. Store cementitious materials off the ground, under cover, and in a dry location.

D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

1.7 PROJECT CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F within 8 hours.
2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F within 8 hours.
3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F for 8 hours.

B. Cold-Weather Requirements for Cementitious Materials: Do not apply unless air temperature is above 40 deg F and will remain so for at least 48 hours after completion of Work.

C. Cold-Weather Requirements for Cementitious Materials: Comply with the following procedures:

1. When air temperature is below 40 deg F, heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F.
2. When mean daily air temperature is between 25 and 40 deg F, cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.
3. When mean daily air temperature is below 25 deg F, provide enclosure and heat to maintain temperatures above 32 deg F within the enclosure for 48 hours after repair.

D. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F and above.

E. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F or above 90 deg F. Apply only to substrates that have been dry for at least 72 hours.

PART 2 - PRODUCTS

2.1 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

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. Euclid Chemical Company (The); Corr-Bond.
    b. Kaufman Products, Inc; Surepoxy HM EPL.

c. Sika Corporation; Armatec 110 EpoCem.
d. Sonneborn, Div. of ChemRex; Sonoprep.
e. Sto Corp., Concrete Restoration Division; Sto Bonding and Anti-Corrosion Agent.
f. Tamms Industries, Inc.; Duralprep A.C.

B. Epoxy Bonding Agent: ASTM C 881/C 881M.

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. Anti-Hydro International, Inc.; Poly-Epoxy Bonding #100.
b. ChemCo Systems; CCS Bonder Liquid.
c. Dayton Superior Corporation.
d. Euclid Chemical Company (The).
e. Kaufman Products, Inc.; SurePoxy HM EPL.
f. MBT Protection and Repair, Div. of ChemRex; Concresive Liquid LPL.
g. Meadows, W. R., Inc.
h. Sika Corporation.
i. Sonneborn, Div. of ChemRex.
j. Tamms Industries, Inc.; Duralbond.
k. ThoRoc, Div. of ChemRex; Epoxy Adhesive 24LPL.
l. Unitex.
m. US MIX Products Company.

3. Thin Film Open Time: Not less than six (6) hours.

C. Latex Bonding Agent: ASTM C 1059.

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. Latex Bonding Agent, Type I:

1) Euclid Chemical Company (The); Euco Weld.
2) Kaufman Products, Inc.; Sureweld.
3) Meadows, W. R. Inc.; Intralok.
4) Sika Corporation; Sikalatex.
5) US MIX Products Company; US Spec Bondcoat.

b. Latex Bonding Agent, Type II:

1) Dayton Superior Corporation; Day-Chem Ad Bond (J-40).
2) Euclid Chemical Company (The); Flex-Con.
3) Kaufman Products, Inc.; Surebond.
4) Meadows, W. R. Inc.; Sealtight Acry-Lok.
5) Sonneborn, Div. of ChemRex; Acrylic Additive.
6) US MIX Products Company; US Spec Acrylcoat.

D. Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 1 part fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.

2.2 PATCHING MORTAR

A. Patching Mortar, General:

1. Unless otherwise indicated, use any of the products specified in this Article.
2. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
3. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.

B. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 sieve.

C. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.

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. Cementitious Patching Mortar:

1) Kaufman Products, Inc.; Hicap.
2) MBT Protection and Repair, Div. of ChemRex.
3) Sika Corporation.
4) Sonneborn, Div. of ChemRex; Deep Pour Mortar.
5) Sto Corp., Concrete Restoration Division; Sto Full-Depth Repair Mortar.
6) ThoRoc, Div. of ChemRex; LA Repair Mortar.

b. Cementitious Patching Mortar, Rapid Setting:

1) CGM, Incorporated; Pro Patching Cement.
2) Dayton Superior Corporation.
3) Euclid Chemical Company (The); Euco-Speed.
4) Fox Industries, Inc.; FX-928 Rapid Hardening Mortar.
5) Kaufman Products, Inc.; Duracrete.
6) Meadows, W. R. Inc.
7) Sika Corporation; Sikaset Roadway Patch.
8) Sonneborn, Div. of ChemRex; Road Patch.
9) Sto Corp., Concrete Restoration Division; Sto Rapid Repair Mortar.
10) Tamms Industries, Inc.; Speed Crete 2028.
11) ThoRoc, Div. of ChemRex.
12) Unitex; Patch Set 928.
13) US MIX Products Company; US Spec Transpatch.
14) Watson Bowman Acme Corp., Degussa AG; Wabo Renew 100.

D. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

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. AQUAFIN, Inc.
b. CGM, Incorporated.
c. Dayton Superior Corporation.
d. Euclid Chemical Company (The).
e. Fox Industries, Inc.
f. Kaufman Products, Inc.
g. MBT Protection and Repair, Div. of ChemRex.
h. Meadows, W. R., Inc..
i. Sika Corporation.

j. Sonneborn, Div. of ChemRex.
k. Sto Corp., Concrete Restoration Division.
l. Tamms Industries, Inc.
m. ThorRoc, Div. of ChemRex, Inc.
n. US MIX Products Company.

E. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a non-redispersible latex additive as either a dry powder or a separate liquid that is added during mixing.

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. Euclid Chemical Company (The).
b. Fox Industries, Inc.
c. MBT Protection and Repair.
d. Meadows, W. R., Inc.
e. Sika Corporation.
f. Sonneborn, Div. of ChemRex.
g. US Mix Products Company.

2.3 CONCRETE

A. Concrete Materials and Admixtures: Comply with Section 03 30 00 Cast-in-Place Concrete.

B. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Section 03 30 00 Cast-in-Place Concrete.

C. Form-Facing Materials: Comply with Section 03 30 00 Cast-in-Place Concrete.

D. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S.

E. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 sieve, 95 to 100 percent passing a No. 16 sieve, 55 to 80 percent passing a No. 30 sieve, 30 to 55 percent passing a No. 50 sieve, 10 to 30 percent passing a No. 100 sieve, 0 to 10 percent passing a No. 200 sieve, and having a fineness modulus of 1.30 to 2.10.

F. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.

G. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.

H. Pozzolans for Grout Used with Preplaced Aggregate: ASTM C 618.

2.4 MISCELLANEOUS MATERIALS

A. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.

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. Anti-Hydro International, Inc.
b. ChemCo Systems; CCS Grout.

c. Euclid Chemical Company (The).
d. Kaufman Products, Inc.
e. MBT Protection and Repair.
f. Meadows, W. R., Inc.
g. Metzger/McGuire.
h. Sika Corporation. i.
Unitex.
j. US Mix Products Company.

B. Polyurea Joint Filler: 2-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.

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. ASTC Polymers.
b. ChemCo Systems; CCS Grout.
c. Dayton Superior Corporation.
d. Euclid Chemical Company (The).
e. MBT Protection and Repair, Div. of ChemRex.
f. Metzger/McGuire.
g. Sonneborn, Div. of ChemRex.

C. Epoxy Crack Injection Adhesive: ASTM C 881/C 881M.

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. ChemCo Systems; CCS Grout.
b. Dayton Superior Corporation.
c. Euclid Chemical Company (The).
d. Kaufman Products, Inc.
e. MBT Protection and Repair, Div. of ChemRex.
f. Meadows, W. R., Inc.; Sealtight Rezi-Weld LV.
g. Sika Corporation.
h. Sonneborn, Div. of ChemRex.
i. Tamms Industries, Inc.; Duralcrete LV.
j. Thermal-Chem; Crack Injection.
k. ThorRoc, Div. of ChemRex, Inc.
l. Unitex.
m. US MIX Products Company; US Spec Maxi - Bond 500LV.

D. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.

E. Corrosion-Inhibiting Treatment Materials: Water-based solution of alkaline corrosion-inhibiting chemicals that penetrates concrete by diffusion and forms a protective film on steel reinforcement.

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. Cortec Corporation.
b. Degussa Corporation; Protectosil CIT.
c. Fox industries, Inc.; FX-361 Migratory Corrosion Inhibitor.
d. Sika Corporation; Sika Ferrogard 903.
e. Sonneborn, Div. of ChemRex; Corrosion Inhibitor.

F. Polymer Overlay: Epoxy adhesive complying with ASTM C 881/C 881M, Type III.

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. Kaufman Products, Inc.
b. Meadows, W. R., Inc.; Sealtight Rezi-Weld Type III DOT.
c. Thermal-Chem; Flexgard T, Product 309.
d. Unitex; Pro-Poxy Type III D.O.T.
e. US MIX Products Company; US SPEC Type III Epoxy Binder.

G. Aggregate for Use with Polymer Overlay: Oven-dried, washed silica sand complying with ACI 503.3.

H. Polymer Sealer: Low-viscosity epoxy penetrating sealer recommended by manufacturer for application to exterior concrete traffic surfaces.

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. Epoxy Sealers:

1) ChemCo Systems; CCS Coating, Epoxy Healer Sealer.
2) Euclid Chemical Company (The); Euco #512 Epoxy Sealer.
3) Fox Industries, Inc.; FX-452 Epoxy Penetrating Sealer.
4) Kaufman Products, Inc.; SurePoxy Penetrating Sealer.
5) MBT Protection and Repair, Div. of ChemRex; Masterseal GP.
6) Thermal-Chem; Hairline Crack Sealer, Product 207.
7) Unitex; Pro-Seal HS.
8) US MIX Products Company; US Spec Eposeal LVS.

b. High-Molecular-Weight Methacrylate Sealers:

1) Meadows, W. R. Inc.; Sealtight Vocomp-25.
2) Sika Corporation; Sikapronto 19.
3) Transpo Industries, Inc.; Sealate T70.

I. Methylmethacrylate Sealer/Brighteners: Clear low-viscosity sealer recommended by manufacturer for sealing exterior exposed-aggregate concrete, and formulated to bring out color of aggregates and give concrete a wet look.

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. Dayton Superior Corporation.
b. Kaufman Products, Inc.
c. Meadows, W. R., Inc.; Sealtight CS-309-25.
d. Tamms Industries, Inc.; Luster Seal 300.
e. Unitex; Bright Rock Sealer.
f. US MIX Products Company.

J. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. After fabricating, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. After preparation, apply one coat of lead- and chromate-free, modified-alkyd primer complying with MPI#76 and one coat of alkyd-gloss enamel complying with MPI#96.
3. After preparation, apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build, urethane or epoxy coating recommended by manufacturer for application over specified zinc-rich primer. Comply with coating manufacturer's written directions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

    a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    b. Products: Subject to compliance with requirements, provide one of the following:

        1) Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19 and M74/M75 Aliphatic Acrylic Urethane Semi-Gloss.
        2) Carboline Company; Carbozinc 621 and Carboguard 890 2-Component Epoxy.
        3) ICI Devoe Coatings; Catha-Coat 313 and Devthane 378 Aliphatic Urethane Semi-Gloss Enamel
        4) International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer and Interthane 870.
        5) PPG Architectural Finishes, Inc; Aquapon Zinc-Rich Primer ABC 97-670 and Aquapon 97-130 Epoxy.
        6) Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer and Macropoxy HS High Solids Epoxy.
        7) Tnemec Company, Inc.; Tneme-Zinc 90-97 and Series 27 Hi-Build Epoxy.

K. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; hot-dip or mechanically zinc coated.

L. Postinstalled Anchors: Expansion anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

M. Composite Structural Reinforcement: Manufacturer's system consisting of carbon or glass-fiber reinforcement in the form of preimpregnated sheets or tow sheet with field-applied saturant, and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as external structural reinforcement for concrete.

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. Sika Corporation; Carbodur and Sikadur 30. b.
    Sumitomo Corporation of America; Replark. c.
    Thermal-Chem; Epic Systems.
    d. VSL (VStructural, LLC), a Structural Group Company; V-Wrap C100. e.
    VSL (VStructural, LLC), a Structural Group Company; V-Wrap EG50. f.
    Watson Bowman Acme Corp., Degussa AG; Wabo MBrace.

2.5 MIXES

A. Mix products, in clean containers, according to manufacturer's written instructions.

1. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.
2. Do not add water, thinners, or additives unless recommended by manufacturer.

3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
4. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

B. Mortar Scrub-Coat: Mix with enough water to provide consistency of thick cream.

C. Dry-Pack Mortar: Mix with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with Section 03 30 00 Cast-in-Place Concrete.

E. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries as directed by Architect. At columns and walls make boundaries level and plumb, unless otherwise indicated.

C. Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer, using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

3.2 PREPARATION

A. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.

1. Erect and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch exterior-grade plywood supported at 16 inches o.c. and covered with asphalt roll roofing.
2. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape or a liquid strippable masking agent. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
3. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off Owner's property.
4. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
5. Collect runoff from wet operations and dispose of by legal means off District's property.

B. Shoring: Install temporary supports before beginning concrete removal.

C. Concrete Removal:

1. Saw-cut perimeter of areas indicated for removal to a depth of at least 1/2 inch. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
2. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
3. Remove additional concrete, if necessary, to provide a depth of removal of at least 1/2 inch over entire removal area.
4. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch clearance around bar.
5. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
6. Provide fractured aggregate surfaces with a profile of at least 1/8 inch that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level, unless otherwise directed.
7. Thoroughly clean removal areas of loose concrete, dust, and debris.

D. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by high-pressure water cleaning, abrasive blast cleaning or wire brushing until only tightly bonded light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in 2 or more adjacent bars, cut bars and remove and replace as directed by Architect. Remove additional concrete as necessary to provide at least 3/4-inch clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318, by lapping, welding, or using mechanical couplings.

E. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than 1 inch deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

F. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete by low-pressure water cleaning, detergent scrubbing or sand blasting to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment.

G. Surface Preparation for Overlays: Remove delaminated material and deteriorated concrete surface material. Roughen surface of concrete by shot blasting, high-pressure water jetting or milling to produce a surface profile matching CSP per ICRI 03732. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.

H. Surface Preparation for Sealers: Clean concrete by shot blasting, low-pressure water cleaning or detergent scrubbing to remove dirt, oils, films, and other materials detrimental to sealer application.

I. Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 per ICRI 03732.

1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
4. When pH is acceptable and surface is clean, vacuum dry.

J. Surface Preparation for Composite Structural Reinforcement: Remove delaminated material and deteriorated concrete surface material. Clean concrete where reinforcement and epoxy patching mortar is to be applied by low-pressure water cleaning or detergent scrubbing to remove dirt, oils, films, and other materials detrimental to epoxy application. Roughen surface of concrete by sand blasting.

3.3 APPLICATION

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars and concrete by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

C. Epoxy Bonding Agent: Apply to reinforcing bars and concrete by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat. Apply patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.

D. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Apply patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.

E. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.

F. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches beyond repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub-coat dries, recoat before applying patching mortar or concrete.

G. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:

1. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar into substrate, filling pores and voids.
2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
3. For vertical patching, place material in lifts of not more than 1 inch nor less than 1/8 inch. Do not feather edge.
4. For overhead patching, place material in lifts of not more than 1 inch nor less than 1/8 inch. Do not feather edge.
5. After each lift is placed, consolidate material and screed surface.
6. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
7. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a smooth surface with a sponge float broom.
8. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

H. Dry-Pack Mortar: Use for deep cavities and where indicated. Unless otherwise recommended by manufacturer, apply as follows:

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.
3. Place dry-pack mortar into cavity by hand, and compact into place with a hardwood drive stick and mallet or hammer. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
4. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
5. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

I. Concrete: Place according to Section 03 30 00 Cast-in-Place Concrete and as follows:

1. Apply epoxy-modified, cementitious bonding and anticorrosion agent to reinforcement and concrete substrate.

2. Apply latex bonding agent to concrete substrate.
3. Use vibrators to consolidate concrete as it is placed.
4. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
5. Place concrete by form and pump method.

    a. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and junctions of forms with existing concrete.
    b. Pump concrete into place, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi.

6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

J. Grouted Preplaced Aggregate Concrete: Use for column and wall repairs where indicated. Place as follows:

1. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and junctions of forms with existing concrete.
2. Apply epoxy-modified, cementitious bonding and anticorrosion agent to reinforcement and concrete substrate.
3. Place aggregate in forms, consolidating aggregate as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
4. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.
5. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi.
6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Repair voids with patching mortar and finish to match surrounding concrete.

K. Joint Filler: Install in nonmoving floor joints where indicated.

1. Install filler to a depth of at least 1 inch. Use fine silica sand no more than 1/4 inch deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

L. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch thick by 1 inch wider than crack.
4. Inject cracks wider than 0.003 inch to a depth of 8 inches or to a width of less than 0.003 inch, whichever is less.
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

M. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete.

1. Apply to areas indicated.

N. Polymer Overlay: Apply according to ACI 503.3.

1. Apply to traffic-bearing surfaces, including parking areas and walks.

O. Polymer Sealer: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.

1. Apply to traffic-bearing surfaces, including parking areas and walks.

P. Methylmethacrylate Sealer/Brighteners: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.

1. Apply to exterior concrete surfaces that are exposed to view, excluding traffic-bearing surfaces.

Q. Composite Structural Reinforcement Using Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, apply as follows:

1. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
2. Apply epoxy adhesive to a thickness of 1/16 inch to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
3. Clean preimpregnated fiber sheet with acetone or other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch.
4. Apply adhesive-coated fiber sheet to adhesive-coated concrete within open time of epoxy adhesive, and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.
5. Apply additional layers as indicated using same procedure.

R. Composite Structural Reinforcement Using Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, apply as follows:

1. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
2. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
3. Apply epoxy saturant to fiber tow sheet or primed and patched surface with 3/8-inch nap roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy as needed to fully saturate tow sheet.
4. Apply additional layers as indicated, fully saturating each with epoxy.
5. After saturant has cured, apply protective topcoat by brush, roller, or spray.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to sample materials and perform tests as follows:

1. Patching Mortar, Packaged Mixes: Three (3) randomly selected samples tested according to ASTM C 928.
2. Patching Mortar, Field Mixed: Three (3) randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
3. Concrete: As specified in Section 03 30 00 Cast-in-Place Concrete.
4. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.

a. Testing Frequency: One sample for each 25 cu. yd. of grout or fraction thereof, but not less than one sample for each day's work.

5. Joint Filler: Core drilled samples to verify proper installation.

   a. Testing Frequency: One sample for each 100 feet of joint filled.
   b. Where samples are taken, fill holes with joint filler.

6. Epoxy Crack Injection: Core drilled samples to verify proper installation.

   a. Testing Frequency: 3 samples from mockup and 1 sample for each 100 feet of crack injected.
   b. Where samples are taken, fill holes with epoxy mortar.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 Provisions of Divisions 01 apply to this section

1.02 SECTION INCLUDES

A. Formwork for cast-in-place concrete as indicated.

B. Installation of items to be embedded in concrete, such as anchor bolts, inserts, embeds, and sleeves.

1.03 RELATED REQUIREMENTS

A. Section 01 42 00: Testing and Inspection.

B. Section 03 20 00: Concrete Reinforcement.

C. Section 03 30 00: Cast-In-Place Concrete

1.04 SYSTEM DESCRIPTION

A. Work shall be in accordance with CBC, Chapter 19A, Concrete.

1.05 SUBMITTALS

A. Submit Shop Drawings indicating locations of forms, joints, embedded items, and accessories.

B. Submit manufacturer's product data for form materials and accessories.

1.06 QUALITY ASSURANCE

A. As a minimum requirement, conform to ACI 347, Chapter 1: Design and Chapter 3: Materials for Formwork; ACI 301, “Specifications for Structural Concrete for Buildings”, as applicable, and for plywood, conform to tables for form design and strength in APA Form V 345.

B. Provide mock-ups for architectural exposed finishes.

1.07 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 inspection and identification.

PART 2 PRODUCTS

2.01 GENERAL

A. Form materials may be reused 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.

D. 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.

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 or fibrous glass reinforced plastic facing.
H. For Exposed Concrete Finish, material can be the following types: plywood, glass, steel and a combination plywood formwork types.
I. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type.
J. Form Coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, or "Cast-Off".
K. Form Liner: Rigid or resilient type.
L. Void Forms: Forms shall be "WallVoid" for temporary support and "SlabVoid" for creating gaps. Void forms shall be fabricated of corrugated paper with moisture resistant exterior and shall be capable of withstanding working load of 1,500 psf.

PART 3 EXECUTION

3.01 GENERAL

A. Forms shall be constructed so as to shape final concrete structure conforming to shape, lines and dimensions of members. They shall be properly braced or tied together and their supports shall be designed so that previously placed structures will not be damaged.

3.02 ERECTION

A. Plywood shall be installed with horizontal joints level, vertical joints plumb and with joints tight. Reused plywood shall bethoroughly cleaned and repaired, nail plywood to maintain alignment and prevent warping.

B. Provide temporary openings at points in formwork to facilitate cleaning and inspection.

3.03 REMOVAL OF FORMS

A. Forms shall not be removed until concrete has sufficiently hydrated and shoring shall not be removed until member has acquired sufficient strength.

B. Compressive strength of in-place concrete shall be determined by testing field-cured specimens representative of concrete location or members, as specified in Cast-In-Place Concrete.

3.04 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.05 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 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete and concrete masonry units.

B. Supports and accessories for steel reinforcement.

1.2 RELATED SECTIONS

A. Section 03 10 00 - Concrete Forms and Accessories.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 03 45 00 - Architectural Precast Concrete: Reinforcement for precast concrete panels.

1.3 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

B. ACI 318- Building Code Requirements For Reinforced Concrete and Commentary; American Concrete Institute International.

C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International.

D. ASTM A 82- Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

E. ASTM A 184/A 184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

F. ASTM A 185- Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

G. ASTM A 497/A 497M- Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

H. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel 1;3ars for Concrete Reinforcement.

I. ASTM A 704/A 704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.

J. ASTM A 706/A 706M- Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

K. ASTM A 996/A 996M -Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

L. AWS D1.4 - Structural Welding Code- Reinforcing Steel; American Welding Society.

M. California Code of Regulations (CCR) Title 24 California Building Code (CBC). 2010 Edition.

N. CRSI (DA4)- Manual of Standard Practice; Concrete Reinforcing Steel Institute.

O. CRSI (P1)- Placing Reinforcing Bars; Concrete Reinforcing Steel Institute.

1.4 SUBMITTALS

A. Shop Drawings: Only when deviations are made from the contract documents, submit shop drawings under provision of Section 01 33 13 with deviations clearly identified.

1. Indicate sizes, spacings, locations and quantities of reinforcing steel, wire fabric, bending and cutting schedules, splicing, stirrup spacing, supporting and spacing devices.

B. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

C. Reports: Submit certified copies of mill test report of reinforcement materials analysis, indicate physical and chemical analysis.

D. Welders Certificates: Submit certifications for welders employed on the project, verifying AWS qualifications within the previous 12 months.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI SP-66.

B. Tests of Reinforcing bars shall be in conformance with 2010 CBC Sections 1916A.2 and 1704A.4.1.

PART 2 - PRODUCTS

2.1 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60.

1. Deformed billet-steel bars.

2. Unfinished.

B. Reinforcing Steel: ASTM A 706/A 706M, deformed low-alloy steel bars.

1. Unfinished.

C. Steel Welded Wire Reinforcement: ASTM A185/A 185M, plain type.

1. Welded Wire Mat Reinforcing: mesh size and gage as indicated on drawings.

D. Steel Welded Wire Reinforcement: ASTM A 497, deformed type.

1. Flat Sheets.

2. Mesh Size and Wire Gage: As indicated on drawings.

E. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage acceptable patented system.

2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement, including load bearing pad on bottom to prevent vapor barrier puncture.

3. Provide stainless steel, plastic, or plastic coated steel components for placement within 1 %" of weathering surfaces.

2.2 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4)- Manual of Standard Practice.

B. Welding of reinforcement, in conformance with 2010 CBC Section 1903A.7 with Table 1704A.3, is permitted only with the specific approval of Structural Engineer. Perform welding in accordance with AWS D1.4.

C. Obtain approval from the architect/engineer for additional reinforcing splices not indicated on drawings.

PART 3 - EXECUTION

3.1 PLACEMENT

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

D. Do not displace or damage vapor barrier.

E. Accommodate placement of formed openings.

3.2 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF
SECTION

SECTION 03 25 00

CONCRETE TOPPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes floor topping with integral color, applied over previously placed base slab at interior and exterior slabs.

1.02 REFERENCES

A. Comply with requirements of Section "Cast-In-Place Concrete" and as herein specified. B.

In addition to sample specified in “Cast-In-Place Concrete” submit 12” square samples of proposed concrete toppings with integral finish for preliminary review.

1.03 SUBMITTALS

A. Furnish laboratory test reports, and materials certificates as specified in Section “Cast-In-Place Concrete.”, submit product data for proprietary products and produce a mock-up of the concrete topping representing the specified color, finish, and joint detail and pattern.

PART 2 PRODUCTS

2.01 CEMENT AND AGGREGATES

A. Portland Cement: ASTM C150, Type I or Type III

B. Aggregate: Normal Weight, ASTM C33

C. Fly Ash will not be permitted

D. Integral Concrete Colorant is produced by natural and synthetic iron oxides and chromium oxides, compounded for use in ready-mix concrete. Mix, place, finish, cure and provide other activities to produce concrete of reasonably uniform color, texture and durability, as approved. Ready-mix concrete may be placed in 2 lifts after review of procedures to assure water-cementitious materials ratio and temperature of both lifts are identical and placement of top lift before initial set of lower lift.

E. Curing Compounds and Sealers are as recommended by colorant manufacturer.

2.02 TOPPING MIX

A. Design mix to produce topping material with f’c = 3000 psi at 28 days, slump and maximum W/C ratio as specified in Section 033000 and 150 lbs per cu. foot.

2.03 MIXING

A. Provide batch type mechanical mixer for mixing topping material at Project site and only use mixers that are capable of mixing aggregates, cement, and water into a uniform mix within specified time

B. Mix each batch after ingredients are in mixer. Ready-mixed topping may be used when acceptable to College’s Representative

PART 3 EXECUTION

3.01 CONDITION OF SURFACES

A. Remove contaminants, leaving a clean surface of hardened concrete. Roughen base slab surface of hardened concrete for acceptable bonding. Dampen slab surface prior to placing topping mixture, which should be placed after rewettable bonding compound has dried or epoxy adhesive is still tacky.

3.02 PLACING AND FINISHING

A. Spread topping mixture evenly to the required elevation and strike off. After the topping has stiffened sufficiently and water sheen has disappeared, float the surface at least twice to a uniform sandy texture.

B. Trowel in joints as shown.

C. After floating, begin trowel finish operation using power driven trowels.

D. Perform operations as necessary to match mock-up and apply a light hand trowel finish followed by the finish indicated after final floating.

3.03 CURING AND PROTECTION

A. Cure concrete with curing compound recommended by the colorant material manufacturer.

B. Protect topping applications and finishes as specified in Section "Cast-In-Place Concrete."

3.04 PERFORMANCE

A. Failure of concrete topping to bond to substrate, or disintegration or other failure of topping to perform as a floor finish will be considered failure of materials and workmanship.

3.05 CLEAN UP

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

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDES:

A. Cast in place structural concrete.

B. Precast concrete.

C. Non-structural concrete.

1.2 RELATED SECTIONS:

A. Section 03 10 00 - Concrete Formwork and Accessories.

B. Section 03 20 00 - Concrete Reinforcement.

C. Section 03 45 00 - Precast Architectural Concrete.

D. Section 07 26 16 – Under Slab Vapor Retarders.

E. Section 07 92 05 – Joint Sealers.

F. Section 32 13 16 - Concrete Paving.

1.3 REFERENCES

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International.

B. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; American Concrete Institute International

C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International.

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.

F. ACI 305R- Hot Weather Concreting; American Concrete Institute International.

G. ACI 306R- Cold Weather Concreting; American Concrete Institute International.

H. ACI 308R- Guide to Curing Concrete; American Concrete Institute International.

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International.

J. ASTM C 33- Standard Specification for Concrete Aggregates.

K. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

L. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete.

M. ASTM C 143/C 143M- Standard Test Method for Slump of Hydraulic-Cement Concrete.

N. ASTM C 150 - Standard Specification for Portland Cement.

O. ASTM C 171 -Standard Specification for Sheet Materials for Curing Concrete.

P. ASTM C 173/C 173M- Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

Q. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

R. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

S. ASTM C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete.

T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete.

U. ASTM C 618- Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

V. ASTM C 685/C 685M – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

W. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

X. ASTM C 1059 - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.

Y. ASTM C 1107/C 1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

Z. ASTM E 1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers.

AA. ASTM E 1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers [Metric].

BB. California Code of Regulations (CCR) Title 24 California Building Code (CBC), 2010 Edition.

1.4 DEFINITIONS

A. Severe Exposure: Concrete which is in contact with moisture or deicing salts, such as pavements, sidewalks, parking garage floors, etc.

B. Moderate Exposure: Concrete which is occasionally exposed to moisture, such as exterior walls, beams, girders, and slabs not in contact with soil, etc.

1.5 SUBMITTALS

.

A. General: Submit in accordance with Section 01 33 13.

B. Shop Drawings: Submit drawings locating slab-on-grade construction joints, control joints, and isolation joints.

C. Product Data: Submit product data for proprietary products.

D. Sample: Provide 48 inch by 48 inch mock-up of each topping slab type, complete with integral color and finish as indicated on architectural color schedule. Sample to be reviewed and approved by architect prior to actual concrete placement of topping slab.

E. Mix Designs:

1. Submit proposed concrete mix designs for each class or use at least 30 days prior to required delivery.

2. Obtain Owner's Testing Laboratory approval prior to submitting mix designs for Architect/Engineer approval.

3. Mixes shall be prepared by a professional engineer licensed in the state in which the project is located.

4. Each concrete mixtures containing fly ash as replacement for Portland Cement or other Portland Cement replacements and for equivalent concrete mixtures that do not contain Portland Cement replacements.

5. Specifically indicate where each class of concrete is to be used.

6. Indicate individual and combined aggregate gradations and aggregate source and characteristics.

F. For concrete, accompany each load of materials or concrete with signed copy of batch plant's certificates stating quantity of each material, amount of water, admixtures, departure time and date.

1. When batch plant inspection is waived, provide affidavit in accordance with Title 24, Part 2, Section 1704A.4.3 to Owner's Testing Laboratory.

G. Test Reports: Submit aggregate and concrete mix test reports from independent testing laboratory as required by Division 1.

1.6 QUALITY ASSURANCE

A. Certifications:

1. Submit material certification for admixtures and aggregates, certifying their compliance with specifications.

2. Submit certified mill test reports for each lot of cement.

B. Perform work of this section in accordance with ACI 301 and ACI 318.

C. Acquire cement from same source and aggregate from same source for entire project.

D. Follow recommendations of ACI 305R for concreting during hot weather.

E. Follow recommendations of ACI 306R for concreting during cold weather.

F. Proportions of concrete shall conform to 2010 CBC, Sections 1905A.2, 1905A.3 and 1905A.4.

1.7 PRE-INSTALLATION CONFERENCE

A. Conduct pre-installation conference in accordance with Section 01 30 00.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Comply with the requirements of Section 03 10 00.

2.2 REINFORCEMENT

A. Comply with the requirements of Section 03 20 00.

2.3 CONCRETE

MATERIALS A. Portland

Cement:

1. ASTM C150, Type as indicated in the structural drawings and in conformance with 2010 CBC, Sections 1704A.4.1 and 1916A.1.

2. Air-entraining portland cement, as defined by ASTM C150, is prohibited.

B. Aggregate:

1. Coarse Aggregate in conformance with 2010 CBC, Sections 1704A.4.1 and 1903A.3:
   a. ASTM C33 for normal weight aggregate.
   b. ASTM C330 for lightweight aggregate.

2. Fine Aggregate: ASTM C33.

3. Exposed Aggregate: To match Architect's

sample. C. Water: Clean, fresh and potable.

D. Admixtures:

1. Calcium chloride, thiocyanates, or admixtures containing more than 0.05 percent chloride ions are not permitted unless approved by Architect.

2. Air Entraining: ASTM C260.

3. Water-reducing: ASTM C494, Type A.

4. High Range Water-reducing (Superplasticizer): ASTM C494, Type F or Type G.

5. Fly Ash: ASTM C 618, Class Nor F (Class Cis not permitted).

   a. Maximum 15% by weight of fly ash or other pozzolan may be substituted for ASTM C-150 Portland Cement.

6. Water-reducing, Non-corrosive, Non-chloride Accelerator:

   a. ASTM C494, Type E.

   b. Submit long term non-corrosive test data from independent testing laboratory using accelerated test method such as electrical potential measure.

7. Water-reducing, Retarding: ASTM C494, Type D.

E. Bonding Admixture:

1. Acrylic or styrene butadiene, non re-emulsifiable.

2. Acceptable Products:

   a. Flex-Con or SBR Latex, Euclid Chemical Company, Cleveland,

   OH. b. Everbond, L&M Construction Chemicals, Inc., Omaha, NE.

   c. lntralok, W. R. Meadows, Inc., Elgin

IL. F. Bonding Grout:

1. Mix consisting of portland cement, part fine sand passing No. 30 mesh sieve, bonding admixture, and water in proportions as recommended by bonding admixture manufacturer.

2. Minimum 1:1 cement to sand ratio.

3. Mix to achieve consistency of thick cream.

2.4 CURING MATERIALS

A. Sheet Curing Materials: ASTM C171; white opaque polyethylene film, white polyethylene coated burlap sheeting, or regular waterproof paper.

B. Dissipating Resin Curing Compounds:

1. ASTM C309, Type 1 [1-D] clear or translucent [with fugitive dye] [Type 2 white pigmented at exterior locations], Class B, free of natural or petroleum waxes. Class A not acceptable.

2. Liquid, membrane forming, 100 percent resin based allowing maximum moisture loss in 72 hours of 0.11 lb/sq. ft..

3. Compatible with subsequent coatings and toppings.

4. Acceptable Products:

a. Kurex, Cham-Masters Corporation, Madison, OH.

b. Kurez DR, Euclid Chemical Company, Cleveland, OH.

c. L&M Cure DR, L&M Construction Chemicals, Inc., Omaha,

NE. d. 3100 Clear, W. R. Meadows, Inc., Elgin, IL.

e. ABCO 1309 Resin Cure, Nox-Crete Chemicals, Omaha,

NE. f. Kurez VOX, Euclid Chemical Co., Cleveland, OH.

g. L&M CureR, L&M Construction Chemicals, Inc,. Omaha, NE

h. 1100 Clear, W.R. Meadows, Elgin, IL.

C. Water Based Acrylic Curing/Sealing Compounds at areas to be left exposed:

1. ASTM C1315, Type I, Class A [B] [C], VOC compliant, free of natural or petroleum waxes. Dries clear with high [medium] gloss sheen.

2. Liquid, membrane forming, minimum 30 percent [20 percent] acrylic resin solids, allowing maximum moisture loss in 72 hours of 0.08 lb/sq. ft.

3. Compatible with subsequent coatings and toppings.

4. Acceptable Products:

a. Super Diamond Clear VOX, Euclid Chemical Company, Cleveland, OH.

b. Dress & Seal WB 30, L&M Construction Chemicals, Inc., Omaha, NE.

c. VOCOMP 30, W. R. Meadows, Inc., Elgin, IL.

2.5 PATCHING AND REPAIR MATERIALS

A. Epoxy Adhesive:

1. 100 percent solids, two component material suitable for use on dry or damp surfaces, conforming to ASTM C881.

2. Acceptable Products and Manufacturers:

a. Concresive Liquid LPL, Master Builders, Inc., Cleveland, OH.

b. Sikadur Hi-Mod 32, Sika Corporation, Lyndhurst, NJ.

c. Euco 452 or 620 System, Euclid Chemical Company, Cleveland, OH.

B. Patching Compound:

1. Polymer modified cementitious mortar.

2. Acceptable Products and Manufacturers:

a. Thin Coat, Concrete Coat, or Verticoat, Euclid Chemical Company, Cleveland, OH.

b. Duratop, L&M Construction Chemicals, Inc., Omaha, NE.

c. Sikatop 121, 122, or 123, Sika Corporation, Lyndhurst, NJ.

C. Patching Mortar:

1. Comprised of same materials and approximately same proportions as used for surrounding concrete, except with coarse aggregate omitted.

2. Consisting of not more than 1 part cement to 2-1/2 parts sand.

3. Substitute white portland cement for portion of gray portland cement to match color of surrounding exposed concrete.

4. Limit mixing water to no more than necessary for handling and placing. Maximum water/cement ratio of 0.50.

D. Bonding Agent:

1. Acrylic, ASTM C1059, Type II, Non redispersable.

2. Acceptable Products and Manufacturers:

a. Everbond, L&M Construction Chemicals, Inc., Omaha, NE.

b. Daraweld-C, Grace Construction Products, Cambridge, MA.

c. lntralok, W. R. Meadows, Inc., Elgin IL.

E. Evaporation Retardants:

1. Eucofilm, Euclid Chemical Co., Cleveland, OH.

2. E-Con, L&M Construction Chemicals, Inc., Omaha, NE.

3. Confilm, Master Builders, Inc., Cleveland, OH.

2.6 CONCRETE MIXES

A. Proportioning shall be in conformance with 2010 CBC Sections 1905A.2, 1905A.3 and 1905A.4.

1. Proportioning shall be by weight of loose, dry material.

a. 94 pounds of cement shall be considered 1 cubic foot.

b. Fine aggregate volume shall be at least 35%, with maximum of 50%, of sum of separate fine and coarse aggregate volumes.

c. Weighing equipment shall be accurate to within 1 pound and be adjustable for varying aggregate moisture content. Beam auxiliary shall register any part of last 100 pounds of each aggregates; aggregate hopper shall have volume adjustment.

2. Lightweight Coarse Aggregate: Measure by volumetric batching.

3. Accurately control proportions, water content, and air content.

a. Admixtures: Conform to type specified.

b. Quantity per sack of cement and method of using admixture shall be in accordance with recommendations of manufacturer and laboratory furnishing mix design.

c. Cement Grout: One part by volume Portland cement and 2-1/2 parts fine aggregate.

d. Mix dry; add just enough water to make mixture flow under its own weight.

e. Patching Mortar: Mix liquid

f. Combine dry mix with liquid and add water in proportions recommended by manufacturer.

B. Mix Design:

1. Submit design mixes for each type and class of concrete based on laboratory trial batch method or field experience methods described in ACI-318, Chapter 5.

2. If trial batch method is used, employ an independent testing agency acceptable to Architect for preparing and reporting proposed mix designs. Mix designs are to be prepared by a professional engineer licensed in the state in which the project is located. Contractor employed testing agency shall not be same firm as Owner employed testing agency;

3. Use concrete of approved mix designs only.

4. The proportioning of ingredients shall provide a concrete readily worked into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding.

5. Do not place concrete until design mix for that class and type of concrete is reviewed by Architect.

6. Indicate locations in structure where each mix design is to be used.

7. Identify each mix design with code number which will be used on batch tickets.

C. Design Compressive Strengths: As indicated on Structural Drawings.

1. Normal Weight Concrete:

a. Compressive strength, when tested in accordance with ASTM C 39/C 39M, strength at 7 days shall be at least 60% of the minimum required 28 day strength unless noted otherwise on drawings.

b. Maximum slump 4 inches.:!: 1".

2. Lightweight Weight Concrete:

a. Compressive strength, when tested in accordance with ASTM C 39/C 39M, strength at 7 days shall be at least 60% of the minimum required 28 day strength unless noted otherwise on drawings.

b. Maximum slump 4 inches.:!: 1".

c. The air dry unit weight shall be determined by ASTM C567, except that the drying time shall be 90 days.

D. Maximum Size of Coarse Aggregate:

1. 1/5 narrowest dimension between form sides.

2. 1/3 depth of slabs.

3. 3/4 of minimum clear distance between reinforcing bars, wires, or bundles of bars.

4. 1 inch maximum for normal weight concrete or 5/8 inch maximum for light weight concrete.

E. Concrete Slump at Point of Discharge:

1. Ramps and Sloping Surfaces: Not more than 3 inches.
2. Reinforced Foundations: Not less than 1 inch and not more than 4 inches.

3. Concrete Containing Superplasticizer: Not more than 9 inches after addition of superplasticizer. Slump before addition of superplasticizer: 2 to 3 inches

4. Other Concrete: Not less than 1 inch and not more than 4 inches.

5. Allowable tolerances of up to 1 inch above maximum indicated provided average of 10 most recent batches tested is less than maximum.

F. Minimum Cement Content: Not less than 470 pounds of total cementitious material per cubic yard of concrete. Not more than 15% flyash or pozzolan cement substitute and not less than 385 pounds of cement per cubic yard of concrete.

G. Water-Cement Ratios for Concrete (by weight):

1. Maximum permissible water cement ratio: 0.50 unless noted otherwise on drawings.

H. Admixtures:

1. Only use admixtures which have been tested and approved in mix designs.

2. Air entraining Admixture:

a. Use in concrete exposed to freezing and thawing at any time during construction or in completed structure.

b. Use in concrete placed at ambient temperatures below 40 degrees F.

c. Tolerance on air content as delivered: Plus or minus 1-1/2 percent.

3. Conform to air content requirements indicated on Drawings.

I. Maximum water soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from all ingredients, expressed as percent by weight of cement as follows:

1. Concrete over galvanized deck: 0.06 percent.

2. Concrete exposed to chloride in service: 0.15 percent.

3. Other concrete: 1.00 percent.

J. Shrinkage Tests:

1. Prior to placing any concrete for walls or horizontal surfaces, a trial batch of each mix design of structural concrete shall be prepared using the aggregates, cement and admixture (if any) proposed for the project. From each trial batch at least 3 specimens for determining drying shrinkage shall be prepared. The drying shrinkage specimens shall be a 4" x 4" x 11" prisms fabricated, cured, dried, and measured in accordance with the requirements of Tentative Method of Test for Length Change of Cement Mortar and Concrete, ASTM C157. The measurements shall be made and reported separately for 7 and 28 days of drying after 7 days of moist curing. The effective gage length of the specimens shall be 10", and except for the foundation concrete, the average drying shrinkage at 35 days shall not exceed .054%.

2. Previous Test: Ready-mixed concrete manufacturer may furnish certified test reports from approved Testing Laboratory as proof of meeting shrinkage requirements, provided aggregate used and concrete covered by such test report conform to mix design approved for use on this project. Method used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs.

K. Use accelerating admixtures in cold weather only when approved by Architect. Use of admixtures will not relax cold weather placement requirements.

2.7 MIXING

A. Ready-Mix Concrete:

1. Comply with ASTM C 94/C 94M.

2. Before using trucks for batching, m1x1ng, and transporting concrete, thoroughly clean trucks and equipment of materials capable of contaminating concrete.

3. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 is required.

4. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 90 minutes to 75 minutes, and when air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

5. Do not add water to ready-mix concrete at Project site except when slump is below specified limits and total water does not exceed the design water-cement ratio; inject added water into mixer and mix thoroughly before discharging.

B. Provide certificate signed by authorized official of supplier with each load of concrete stating following:

1. Time truck left plant.

2. Mix of concrete, identify with code number of mix design.

3. Amount of water and cement in mix.

4. Amount and type of admixtures.

5. Amount of water added at project site.

6. Time truck is unloaded at project site.

C. Truck mixers without batch tickets will be rejected.

D. Retain certificates at Project site. Submit to Architect for review upon request.

2.8 PRODUCTION

A. Ready Mixed Concrete

1. Except as otherwise provided in these specifications, ready mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94 "Specification for Ready Mixed Concrete."

B. Lightweight Concrete

1. Lightweight concrete shall be batched and mixed as recommended by the concrete supplier to achieve accurate volume and the necessary quality.

2. Aggregate storage conditions, batching, and mixing procedures shall prevent premature slump loss of the concrete during delivery and discharge.

C. Mixing Water Control

1. Concrete which arrives at the jobsite with slump below that specified for placement may be adjusted by the addition of water to increase slump, provided the maximum slump is not exceeded and the maximum water content of the design mix is not exceeded. Following any such water addition, the concrete shall be mixed at mixing speed for at least 30 revolutions of the drum.

2. After adjustment is made to the proper slump, the concrete shall be discharged as long as it retains its placeability without the further addition of water.

3. Concrete shall be placed within one and one half hours after mixer is charged in average conditions. Time shall be reduced to one hour during hot weather concreting.

2.9 SOURCE QUALITY CONTROL

A. Testing will be performed under the provisions of Section 01 40 00, except as otherwise specified.

B. Independent Testing Laboratory, approved by Architect and employed by Contractor, is responsible for:

1. Testing aggregate as follows at start of work and whenever change in aggregate source occurs:

a. Gradation and fineness modulus: ASTM C136.

b. Specific gravity: ASTM C127 for coarse aggregate, ASTM C128 for fine aggregate.

c. Organic impurities: ASTM C40.

d. Effect of organic impurities on strength: ASTM C87 for effect of organic impurities on strength.

e. Potential reactivity of aggregate: ASTM C295, petrographic examination.

f. Soundness: ASTM C88.

g. Reports of tests conducted on aggregates from the same source within the past 12 months will be acceptable.

2. Testing concrete mixes as follows at start of work and whenever change in materials source occurs:

a. Prepare mix designs, test concrete strength, and report results if trial batch method is used to establish design mix proportions. Mix design shall be reviewed, approved, sealed and stamped by a Licensed Professional Engineer in the state where the project is located.

C. Independent Testing Laboratory, employed by Owner, is responsible for observing and evaluating the following at batch plant at start of Work and at other times as requested by the Architect:

1. Condition of batching equipment.
2. Conformance with design mix proportions.
3. Storage of materials.
4. Mixing equipment.
5. Mixing and transporting equipment.
6. Other testing to verify compliance if requested by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and proceed with Work in accordance with Section 01 70 00.

B. Verify forms, reinforcement, anchors, plates, joint materials, vapor retarder and other items to be cast into concrete are accurately placed and held securely.

C. Verify forms are free of debris and water.

D. Verify excavations are free of loose material and water.

3.2 TESTING

A. Concrete materials and operations shall be tested and inspected for compliance with the specifications and requirements. Strength Tests of concrete shall be in conformance with 2010 CBC, Sections 1905A.1.1 and 1905A.6.

3.3 TESTING AGENCY

A. The testing agency shall be designated by the Owner. Ample time shall be allowed for preliminary tests as required prior to concreting operations.

B. All testing agency personnel shall meet the requirements of ASTM E329, "Recommended Practice of Inspecting and Testing Agencies for Concrete and Steel in Construction."

C. All testing agency personnel shall have the knowledge and ability to perform the necessary tests equivalent to the minimum guideline for Certification of Concrete Field Testing Technicians, Grade 1 in accordance with ACI CP-2.

3.4 DUTIES AND SERVICES

A. The duties and responsibilities of the testing agency and the contractor and services to be performed by each are as designated in ACI 301, Chapter 16, "Specifications for Structural Concrete for Buildings."

3.5 EVALUATION AND ACCEPTANCE

A. Test results of standard cylinders, molded, cured, and tested according to ASTM C31 and C39 should be evaluated separately for each concrete mix according to ACI 214, "Recommended Practice for Evaluation of Concrete Compression Test Results of Field Concrete."

B. The criteria for acceptance of concrete shall be as detailed in ACI 318, Chapter 5, Section 5.6, "Evaluation and Acceptance of Concrete" or as per ASTM C94, Section 17 "Strength" and Section 18 "Failure to Meet Strength Requirements."

C. As referenced in ASTM C94 – Section 4.4, "When the strength of concrete is used as a basis for acceptance, the manufacturer shall be entitled to copies of all test reports."

3.6 PREPARATION

A. Construction Joints:

1. Clean previously placed concrete of laitance.

2. Clean reinforcement and accessories of mortar from previous concrete placement operations.

3. Apply bonding agent in accordance with manufacturer's recommendations.

4. Moisten surface of previously placed concrete.

3.7 PLACEMENT

A. Place concrete according to ACI 301 and 304R, except as modified and supplemented on Drawings or in this Section.

B. Notify Architect, Inspector of Record, and Owner's testing laboratory in writing according to Inspection request documents a minimum of 72 hours prior to commencement of placing operations.

C. Cold Weather Concreting:

1. Comply with requirements of ACI 306.1.

2. Do not place concrete when ambient air temperature is expected to fall below 40 degrees F within 24 hours, except with prior written approval of Architect.

3. Remove frost, ice, and snow from formwork, reinforcing, and accessories prior to placing concrete.

4. Do not place concrete foundations, footings or slabs on frozen ground.

5. Limit concrete temperature at time of discharge to 55 degrees F for sections less than 12 inches in any dimension and to 50 degrees F for other sections.

D. Hot Weather Concreting:

1. Comply with requirements of ACI 305R when ambient air temperature exceeds 75 degrees F.

2. Use water-reducing, retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions to extend setting time to limits specified as approved by Architect.

3. Cool aggregates, cool mixing water, substitute ice for part of mixing water, or take other measures to limit concrete temperature at time of discharge to 90 degrees F.

4. Cover reinforcing steel and steel forms with water soaked burlap or use fog spray to limit temperature of steel to 120 degrees F immediately prior to concrete placement.

5. Use evaporation retardant between finishing passes.

E. At time of placement, provide concrete temperature between 50 degrees F and 90 degrees F.

F. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

G. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches and seal watertight.

H. Separate slabs on grade from vertical surfaces with joint filler.

I. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

J. Extend joint filler from bottom of slab to within 1/2 inch of finished slab surface. Conform to Section 07 90 05 for finish joint sealer requirements.

K. Install joint devices in accordance with manufacturer's instructions.

L. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

M. Apply sealants in joint devices in accordance with Section 07 90 05.

N. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

O. Place concrete continuously between predetermined expansion, control, and construction joints.

P. Do not interrupt successive placement; do not permit cold joints to occur.

Q. Place floor slabs in pattern indicated.

R. Saw cut joints within 12 hours after placing.

S. Screed floors level, maintaining surface flatness of maximum 1/4 inch in 10ft.

T. Maintain surfaces receiving concrete at approximately same temperature as concrete being placed.

U. Maintain surface of hardened concrete below 100 degrees F.

V. Convey concrete from mixer to place of deposit by method that will prevent segregation or loss of material, and that will not require addition of water to produce desired slump at point of placement. Do not use supported reinforcing as runway base for concrete conveying equipment.

W. Depositing:

1. Deposit concrete as nearly as practicable to its final location.

2. Place concrete continuously between construction joints.

3. Deposit concrete in layers not exceeding 24 inches in depth.

4. Avoid inclined layers.

5. Place each layer while preceding layer is still plastic.

6. Do not allow free fall of concrete to exceed 4 feet. Do not allow free fall of concrete containing high-range water reducing admixture to exceed 10 feet.

7. Drop concrete in vertical direction, not at incline.

8. If forms and reinforcing above level of concrete already in place become coated with accumulations of hardened or partially hardened concrete, remove accumulations before proceeding.

9. Place concrete without displacing reinforcing and accessories.

X. Consolidation:

1. Vibrate concrete to eliminate formation of surface air voids, honeycombs and sand streaks.

2. Use mechanical, internal vibrators with proper frequency, rpm, and spud size. Select spud for size and spacing of reinforcement and clearance to formwork. Supplement vibration by hand-spading, rodding, or tamping.

3. Insert and withdraw vibrator vertically at spacing not to exceed 1-1/2 times radius of action of vibrator, maximum of 24 inch centers.

4. Insert vibrators into placed layer and at least 6 inches into preceding layer.

5. Do not allow vibrator to touch form face or embedded items.

6. Do not use mechanical vibration for slabs less than 4 inches thick. Use hand spading and tamping in these locations.

Y. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in continuous operation, in single layer, within limits of construction joints, until placing of panel or section is completed.

2. Bring slab surfaces to correct level with straightedge and strike-off.

3. Use bull floats, highway straight edges, or darbies to produce smooth surface, free of humps or hollows before bleed water appears on surface.

4. Do not disturb slab surfaces prior to beginning finishing operations.

Z. Non-Structural Concrete Topping:

1. Placement on same day:

a. Place and consolidate base slab.

b. Screed to elevation to allow for topping slab thickness.

c. After bleed water has disappeared and surface will support worker's weight without indentation, place topping mixture, compact, float and finish.

2. Placement after one day:

a. Place and consolidate base slab.

b. Brush partially set surface with wire broom to remove laitance and scratch surface.

c. Wet cure base slab at least three days.

d. Immediately, prior to placing topping, clean base slab and dampen surface.

e. Scrub bonding grout into base slab surface, or apply bonding agent in accordance with manufacturer's recommendations.

f. Rewettable bonding agent may be used only in areas not subject to wet conditions.

g. Place topping slab before grout has set or dried, compact, float and finish.

M. Curbs and Equipment Pads:

1. Form curbs and equipment pads in areas indicated.

2. Placement on same day:

a. Place and consolidate base slab.

b. Screed to elevation to allow for curb/pad thickness.

c. After bleed water has disappeared and surface will support worker's weight without indentation, place curb/pad concrete mixture, compact, and float.

3. Placement after one day:

a. Place and consolidate base slab.

b. Brush partially set surface with wire broom to remove laitance and scratch surface.

c. Wet cure base slab at least three days.

d. Immediately, prior to placing curb/pad concrete, clean base slab and dampen surface.

e. Scrub bonding grout into base slab surface, or apply bonding agent in accordance with manufacturer's recommendations.

f. Place curb/pad concrete before grout has set or dried, compact and float.

4. Finish interior curbs and pads by stripping forms while concrete is still green and steel trowel surfaces to hard, dense finish with corners, intersections and terminations slightly rounded.

3.8 DEPOSITING

A. Concrete shall be continuously deposited. When continuous placement is not possible, construction joints shall be located as approved by the Architect. Concrete shall be deposited as close to its final point of placement as possible.

B. Concrete shall be consolidated by vibration, spading, rodding or forking. Work concrete around reinforcements, embedded items and into corners. Eliminate all air or rock pockets and other causes of honeycombing, pitting or planes of weakness.

C. Internal vibration shall have a minimum frequency with amplitude to consolidate the concrete effectively. See ACI 309, "Recommended Practice for Consolidation of Concrete."

1. Vibrators shall be operated by experienced and competent workmen.

2. Use of vibrators to transport concrete shall not be allowed.

3. Vibrators shall be vertically inserted every 18 inches for 5 to 15 seconds and then withdrawn.

3.9 FINISHING

A. General: Provide finishes at specified locations, unless indicated otherwise.

B. Finishing Formed Surfaces:

1. Rough Form Finish:

a. Leave surfaces with texture imparted by forms, except patch tie holes and defects.

b. Remove fins and other projections exceeding 1/4 inch in height.

c. Locations: Concrete surfaces not exposed to view.

2. Smooth Form Finish:

a. Provide smooth, hard, uniform surface with minimum number of seams.

b. Repair and patch defective areas, fill tie holes, remove fins and other projections completely.

c. Locations: Exposed concrete surfaces or concrete surfaces designated to receive coatings applied directly to concrete, such as waterproofing, dampproofing, plaster, painting, and other similar applied finishes.

3. Smooth Rubbed Finish:

a. Provide smooth rubbed finish to newly hardened concrete, which has already received smooth form finish, not later than one day after form removal.

b. Moisten concrete surfaces and rub with carborundum brick or other abrasive device until uniform color and texture is produced.

c. Do not use cement grout other than cement paste drawn from concrete by rubbing process.

d. Locations: Where scheduled or indicated on Architectural Drawings.

4. Grout Cleaned Finish:

a. Provide grout cleaned finish to smooth form finished concrete which are complete and accessible.

b. Blend one part portland cement with 1-1/2 parts fine sand and mix with 1:1 ratio of bonding admixture and water to achieve consistency of thick paint. Match color of surrounding concrete.

b. Begin floating when surface water has disappeared and when concrete has

c. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray.

d. Immediately after applying grout, scrub surface vigorously with cork float or stone to coat surface and fill air bubbles and holes.

e. While grout is still plastic, remove excess grout by working surface with rubber float, sack or other means.

f. After surface becomes white from drying, rub vigorously with clean burlap.

g. Keep surface damp for minimum 36 hours after final rubbing.

h. Locations: Where scheduled or indicated on Architectural Drawings.

5. Cork Float Finish:

a. Remove forms at early stage, not later than 3 days after placement of concrete; ream control joints as indicated on Architectural Drawings.

b. Provide cork float finish to concrete which has already received smooth form finish.
   1) Mix one part portland cement and one part fine sand with sufficient water to produce stiff mortar.
   2) Dampen wall surface.
   3) Apply mortar with firm rubber float or trowel, filling voids.
   4) Compress mortar into voids using slow-speed grinder or stone.
   5) If mortar surface dries too rapidly to permit proper compacting and finishing, apply small amount of water with fog sprayer.
   6) Produce final texture with cork float using swirling motion.
   7) Locations: Where [scheduled] indicated on Drawings.

C. Finishes for Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces, strike-off smooth and finish with texture matching adjacent formed surfaces.

D. Slab Finishes:

1. Floor flatness/levelness tolerances:

a. FF defines maximum floor curvature allowed over 24 inches. Computed on basis of successive 12 inch elevation differentials, FF is commonly referred to as "flatness F-Number."

FF = 4.57

Maximum difference in elevation, in inches, between successive 12 inch elevation differences.

b. FL defines relative conformity of floor surface to horizontal plane as measured over 10 feet distance. FL is commonly referred to as "levelness F-Number."

FL = 12.5

Maximum difference in elevation, in inches, between two points separated by 120 inches.

c. Measure floors in accordance with ASTM E1155.

d. Ensure slabs achieve specified overall tolerances. Minimum local tolerance (1/2 bay or as designated by Architect) is 2/3 of specified tolerance unless noted otherwise.

2. Float Finish:

a. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.

b. Begin floating when surface water has disappeared and when concrete has stiffened sufficiently to permit operation of power-driven floats.

c. Cut down high spots and fill low spots.

d. Immediately after leveling, re-float surface to uniform, sandy texture and a FF20/FL17 tolerance.

e. Locations: Surfaces requiring trowel finish [, broom finish] [, slab surfaces covered with insulation] [, waterproofing membrane] [, exposed aggregate finish] [, and] [sand bed terrazzo].

3. Trowel Finish:

a. After float finish, follow by power troweling and then hand troweling.

b. Begin final troweling when surface produces ringing sound as trowel is moved over surface.

c. Finish surface free of trowel marks, uniform in texture and appearance, and to FF25/FL20 elevated slab tolerance.

d. Grind surface smooth to remove defects which may telegraph through applied finish.

e. Locations: Slabs left exposed to view, slabs covered with resilient flooring [,carpet] [, paint] and other similar applied finish.

4. Medium Broom Finish:

a. After float finish, while surface is still plastic, draw fiber bristle broom uniformly over surface to provide texture perpendicular to main traffic or at right angles to floor slope [to match Architect's sample].

b. Locations: Sidewalks, ramps, exterior steps, landings, and platforms.

E. Construction and Control Joints in Slab-on-grade:

1. Construction joints to coincide with planned control joint pattern.

2. Provide joints in at column lines and as indicated on Drawings.

3. Tooling Control Joints and Construction Joints:

a. Slabs Exposed to Vie: Tool joints after finishing slab.

b. Concealed Slabs:
1) Provide joints immediately after final finishing.
2) Use dry-cut sawing system (Soft-Cut) to depth of 1 inch unless noted otherwise; without dislodging aggregates by sawing. Complete sawing no later than two hours after finishing at each control joint location.

3.10 CURING

A. General:

1. Comply with ACI-308, except as modified or supplemented.

2. Start immediately after placing and finishing concrete.

3. Protect from premature drying, temperature extremes, temperature variations, rain, flowing water, and mechanical injury.

4. Cure continuously, without allowing to dry, for minimum period required for hydration of cement and hardening of concrete.

5. Maintain temperature of concrete above 50 degrees F for curing period.

6. Minimum Length of Curing Period:

   a. High Early Strength Concrete: 3 days.

   b. Other Concrete: 7 days.

B. Acceptable Curing Methods:

1. Concrete to receive Waterproofing, Dampproofing, or Membrane Roofing: Moist curing, moisture-retaining sheet covering, or chemical curing compounds.

2. Concrete to receive Hardeners or Sealers: Moist curing, moisture-retaining sheet covering, dissipating resin compounds, or chemical curing compounds; acceptable to manufacturer of hardener or sealer.

3. Concrete to receive Cement Setting Beds, Bonded Toppings: Moist curing, moisture-retaining sheet covering, or chemical curing compounds.

4. Concrete to receive Adhered Finishes: Moist curing, moisture-retaining sheet covering, acrylic curing/sealing compounds, dissipating resin compounds, or chemical curing compounds; acceptable to manufacturer of applied finish.

5. Concrete exposed to Direct Sun when Ambient Temperature Exceeds 75 degrees F: Where permitted, use white pigmented liquid compounds.

6. Other Concrete: Moist curing, moisture-retaining sheet covering, liquid membrane-forming compounds, or chemical curing compounds.

C. Acceptable Curing Procedures:

1. Moist Curing Unformed Surfaces:

   a. Ponding: Maintain 100 percent coverage of water continuously.

   b. Fog Spraying or Sprinkling: Maintain continuously moist with nozzles or sprayers.

   c. Fabric Mats: Cover surfaces with wet burlap or other absorptive material which will not discolor concrete; keep continuously wet.

   d. Sand: Minimum 2 inch thick layer, kept continuously saturated with water, free from deleterious materials which would stain concrete.

2. Sheet Curing Unformed Surfaces:

   a. Wet surface of concrete with fine spray of water prior to applying sheet.

   b. Immediately cover surface with polyethylene sheeting, waterproof paper, or burlap-polyethylene sheet.

   c. Lap edges of sheeting minimum of 12 inches.

   d. Repair damaged sheet.

   e. Ballast sheet to prevent movement and blow-off.

3. Liquid Membrane-forming Compound Curing of Unformed Surfaces:

a. Apply in accordance with manufacturer's recommendations. b.

Protect surfaces from foot and vehicular traffic.

c. Curing compounds used must be compatible with adhesives used in setting carpet, resilient tile or sheeting flooring, and other similar finishes.

4. Curing of surfaces which are moist cured for first 24 hours may be cured by other acceptable methods for remaining curing period provided they are not allowed to become dry.

3.11 FIELD QUALITY CONTROL

A. Field testing will be performed under the provisions of Section 01 45 00. B.

Independent testing laboratory, employed by Owner, is responsible for:

1. Sampling Fresh Concrete: ASTM C172, sample at point of discharge from mixer and additionally at point of discharge from end of pipe for concrete conveyed by pumping methods; if water is added at Project site, obtain another sample for testing.

2. Concrete Temperature: Test each time slump and air content are tested and each time set of compressive strength test specimens is made.

3. Slump: ASTM C143; one test from first truck at point of discharge each day, one test each time set of compressive strength test specimens is made, and when change in consistency occurs.

4. Air Content of Plastic Mix:

a. For Normal Weight, Air Entrained Concrete: ASTM C231, pressure method or ASTM C173, volumetric method.

b. For Lightweight, Air Entrained Concrete: ASTM C173, volumetric method.

c. Make one test each time a set of compressive strength test specimens is made.

5. Compressive Strength Tests:

a. Make and cure test specimens in accordance with ASTM C31, from concrete sampled at point of discharge from mixer and additionally at point of discharge from end of pipe for concrete conveyed by pumping methods.

b. Make one set of 4 test cylinder specimens for every 100 cubic yards, or for every 5000 square feet of slabs and walls, or fraction thereof, of each class of concrete, with at least one set for each class each day.

c. Test cylinders in accordance with ASTM C39, 2 at 7 days for information, and 2 at 28 days for acceptance.

d. When frequency of testing will provide less than five strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches, or from each batch if fewer than 5 are used.

6. Environmental Conditions:

a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperature in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.

b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative

humidity; record maximum wind velocity, and record maximum temperature of surface of hardened concrete.

7. Observe conveying, placement and consolidation of concrete for conformance to Specifications.

8. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.

9. Observe curing procedures for conformance with Specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.

10. Observe Preparations for Placement of Concrete:

    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compacting equipment.

    b. Inspect preparation of construction, expansion, and isolation joints.

11. Observe preparations for protection from hot weather, cold weather, sun, and rain and preparations for curing.

12. Observations of Concrete Mixing:

    a. Monitor and record amount of water added at Project site.

    b. Observe minimum and maximum mixing times.

13. Other Inspections:

    a. Grouting under base plates.

    b. Grouting anchor bolts and reinforcing steel in hardened concrete.

14. Verify slab flatness and levelness within 24 hours of placement for each slab finish at slab-on-grade and framed slabs in accordance with ASTM E1155. Perform minimum of 2 tests for each slab and finish; one at initial pour and second randomly chosen by testing laboratory.

C. Evaluation and Acceptance of Concrete:

1. Strength Test: Defined as average strength of two 28 day cylinder tests from each set of cylinders.

2. Acceptance Criteria Based on Strength Tests: Strength level of individual class of concrete is considered satisfactory if both:

    a. Average of three consecutive strength test results equal or exceed required design compressive strength, and

    b. No individual strength test results falls below required design compressive strength by more than 500 psi.

3. Acceptance Criteria Based on Field Tests:

    a. Core Tests: Where strength tests indicate concrete of deficient strength, obtain and test cores in accordance with ASTM C42, ACI 318 and ACI-301, at locations directed by Architect.

b. Strength level of concrete in area represented by core test is considered adequate if complies with the requirements of ACI 318.

c. Fill core holes with low slump concrete or patching mortar used to repair surface defects.

4. Revise concrete mix proportions, curing procedures and protection as necessary to provide concrete conforming to Specifications.

D. Acceptance of Structure:

1. Acceptance of structure for dimensional tolerances, appearance, and strength will be based on ACI-301, Chapter 18.

2. Remove and replace concrete which does not meet acceptance criteria.

3.12 PATCHING AND REPAIRING DEFECTIVE CONCRETE

A. General:

1. Rewettable bonding agent may be used only in areas not subject to wet conditions.

2. Patching compound may only be used for concrete not exposed to view.

B. Repairing Formed Surfaces:

1. Surface Defects Requiring Repair:

a. Color and texture irregularities.

b. Honeycomb, air bubbles, rock pockets, and spalls.

c. Fins, burrs and other surface projections.

d. Cracks.

e. Stains and other discolorations that cannot be removed by cleaning.

2. Patch defective areas and tie holes immediately after removal of forms.

3. Cut out honeycomb, rock pockets, and voids over 1/4 inch down to solid concrete but not less than 1 inch depth.

4. Make edges of cuts perpendicular to concrete surface.

5. Clean and dampen area including 6 inches of surrounding surface with water.

6. Apply bonding grout by brushing into surface, after surface water has evaporated.

7. Place patching mortar or patching compound before grout has set or dried.

8. Compact patching material in place and strike off slightly higher than surrounding surface.

9. Finh after minimum of one hour to match surrounding surface.

10. Flush out form tie holes, fill with patching mortar, patching compound, or precast cement cone plugs secured in place with bonding compound.

11. Cure repair areas by same methods as surrounding concrete or keep continuously damp for 7 days.

C. Repairing Unformed Surfaces:

1. Surface Defects Requiring Repair:

a. Fine crazing cracks.

b. Cracks larger than 0.012 inch wide or cracks which penetrate to reinforcing.

c. Cracks penetrating completely through non-reinforced sections.

d. Spalling, popouts, honeycomb, and rock pockets.

e. High and low areas in slabs.

2. Correct high areas in hardened concrete by grinding after concrete has cured at least 14 days.

3. Correct high and low areas during, or immediately after, completion of initial floating operations by cutting high areas and by placing fresh concrete in low areas.

4. Repair defective areas, except isolated random cracks and single holes not exceeding 1 inch diameter, by cutting out and replacing with patching mortar or patching compound.

a. Remove defective areas to sound concrete with clean, square cuts.

b. Dampen concrete surfaces in contact with patching material and apply bonding grout by brushing into surface, after surface water has disappeared.

c. Place patching mortar or patching compound before grout has set or dried.

d. Compact and finish to blend with adjacent finished concrete.

e. Cure in same manner as adjacent concrete.

5. Repair isolated random cracks and single holes not over 1 inch diameter with patching mortar.

a. Groove top of cracks and cut out holes to sound concrete and clean area.

b. Dampen cleaned surfaces and apply bonding grout by brushing into surface, after surface water has disappeared.

c. Place patching material before bonding grout is set or dry.

d. Compact in place and finish to match adjacent concrete.

e. Keep patched area continuously moist for not less than 72 hours.

D. Structural Repairs: Contractor shall proposed materials, methods, and procedures to the Architect for review and approval prior to proceed with structural repairs.

3.13 PROTECTION

A. Protect finished work in accordance with Section 01 70 00.

B. Protect concrete from construction traffic, weather, or mechanical damage for 14 days after placing.

C. Provide raised runways for traffic areas.

D. Protect concrete from staining.

END OF SECTION

SECTION 03 45 00

PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete wall caps.

B. Supports, anchors, and attachments.

C. Intermediate and perimeter joint seals.

D. Grouting under panels.

1.02 SUBMITTALS

A. See Section 01 33 13 - Submittal Procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, location of lifting devices, dimensions, openings, and relationship to adjacent materials.

1. Include details of mix designs.

D. Samples: Submit two cap samples, full size width and height by 16 inches long in size, illustrating surface finish, color and texture.

E. Fabricator qualifications.

1.03 QUALITY ASSURANCE

A. Design Engineer Qualifications: Design precast concrete units under direct supervision of a Professional Structural Engineer experienced in design of precast concrete and licensed in California.

B. Fabricator Qualifications:

1. Firm having at least 5 years of documented experience in production of precast concrete of the type required.

C. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

D. Mark units with date of production in location that will be concealed after installation.

PART 2 PRODUCTS

2.01 PRECAST UNITS

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.

1. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as required by California Building Code.

2. Calculate structural properties of units in accordance with ACI 318.

3. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with strength and appearance requirements.

4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

2.02 REINFORCEMENT

A. Comply with requirements of Section 03 20 00.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150, Type I - Normal Portland type.

B. Lightweight Structural Aggregate: ASTM C330.

C. Water: Clean and not detrimental to concrete.

D. Fiber Reinforcement: Synthetic fiber shown to be resistant to long-term deterioration when exposed to moisture and alkalis; 1/2 inch length.

E. Admixtures: Air entrainment as specified in Section 03 30 00.

F. Grout:

1. Non-shrink, non-metallic, minimum 10,000 psi, 28 day strength.

2. Epoxy.

2.04 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A36/A36M steel; hot-dip galvanized in accordance with ASTM A153/A153M.

1. Clean surfaces of rust, scale, grease, and foreign matter.

2. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.

B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (A 563M) nuts and matching washers.

C. Primer: Zinc rich type.

2.05 ACCESSORIES

A. Bearing Pads: High density plastic; Shore A Durometer as recommended by fabricator; 1/8 inch thick, smooth both sides.

B. Sealant: SJ-1 type specified in Section 07 90 05.

2.06 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.

B. Maintain plant records and quality control program during production of precast units. Make records available upon request.

C. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

D. Use form liners in accordance with manufacturer's instructions.

E. Maintain consistent quality during manufacture.

F. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.

G. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

H. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.07 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135.

PART 3 EXECUTION

3.01 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.

B. Erect units level and plumb within allowable tolerances.

C. Align and maintain uniform horizontal and vertical joints as erection progresses.

D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise tBP/Architecture.

E. Fasten units in place with mechanical connections.

F. Fasten units in place with mortar.

G. Exposed Joint Dimension: 1/2 inch. Adjust units so that joint dimensions are within tolerances.

H. Seal perimeter and intermediate joints in accordance with Section 07 90 05.

3.02 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135.

END OF SECTION

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. This section covers painting of exposed elements of the project, interior and exterior, Sealing and backpriming of wood in the field. Surfaces that are left unfinished by requirements of other sections shall be finished as part of this section.

1.02 SECTION EXCLUDES:

A. Control panels and control systems.

B. Fabric connections to fans.

C. Flexible conduit connections to equipment, miscellaneous name plates, stamping and instruction labels and manufacturer's data.

D. Equipment and products having a complete factory finish, except as specified or noted on drawings.

E. Flag, floodlight, parking light poles and loudspeaker poles furnished with a factory finish.

F. The following items if specified or furnished with galvanized finish shall not be painted: Metal shelving, chain link fencing, areaway and catch basin gratings and frames.

G. Brass, bronze, lead, stainless steel, and chrome or nickel-plated elements.

H. Non-metallic walking surfaces unless specifically shown or specified to be painted.

I. Fire rating labels at fire doors and frames.

J. Cement masonry units at exterior.

1.03 RELATED SECTIONS:

A. Section 05500 - Metal Fabrications.

B. Section 06200 - Finish Carpentry.

C. Section 07600 – Flashing and Sheet Metal

D. Section 08100 – Hollow Metal Doors and Frames.

E. Section 08210 - Wood Doors.

F. Section 08310 – Access Panels.

G. Section 09210 – Gypsum Plaster.

H. Section 09220 – Portland Cement Plaster.

I. Section 09250 – Gypsum Board System.

1.04 QUALITY ASSURANCE

A. Certification of Materials: With every delivery of paint materials, the manufacturer shall certify on the manufacturer's letterhead that materials comply with the requirements of this section.

B. 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.

C. Coats: The number of coats specified is the minimum number acceptable. If full coverage is not obtained with the specified number of coats, apply such additional coats as are necessary to produce the required finish.

D. Employ coats and undercoats for all types of finishes in strict accordance with the recommendations of the paint manufacturer and approved by Architect.

1.04 SUBMITTALS

A. Submittals shall be made in accordance with Section 01300.

B. List of Paint Materials: Prior to submittal of samples, submit a complete list of proposed paint materials, identifying each material by 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 usage, and preparation and application methods. Identify surfaces to receive various paint materials. Do not deviate from approved list.

C. Submit manufacturer's standard color samples for each type of paint used. Once colors have been selected, submit 3 samples of each color selected for each type of paint, on standard 8-1/2 x 11 inch spray-out panel with substrate textures demonstrated.

D. For transparent and stained finishes, prepare samples on same species and quality of wood to be installed on the project, showing system used.

E. An MSDS sheet will be included with each individual submittal.

1.05 DELIVERY, STORAGE AND HANDLING

A. Materials shall be delivered to the project site in original unbroken containers bearing manufacturer's name, brand number and batch number corresponding to description on list of materials as approved.

B. Open and mix ingredients on the premises in the presence of the District Inspector. Immediately remove rejected materials from the premises.

C. Storage and Mixing of Materials: Store materials and mix only in spaces designated for the purpose by the District Inspector. Keep such spaces clean and take necessary precautions to prevent fire. Hang out oily rags flat and singly in the open air. Stack paint containers so that manufacturer's labels are clearly displayed.

1.06 ENVIRONMENTAL CONDITIONS

A. Temperature: Do not apply exterior paint in damp, rainy or foggy weather or until the surface has thoroughly dried from the effects of such weather. Do not apply paint, interior or exterior, when the temperature is below 50 or above 90 degrees F., or dust conditions are unfavorable to proper workmanship.

1.07 GUARANTEE

A. Materials and workmanship guarantee shall be in accordance with the requirements of the Contract Documents, except that guarantee shall be furnished jointly by the Contractor and the materials manufacturer.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Use the paint products of one Paint manufacturer unless otherwise specified or approved. In any case, primers, intermediate and finish coats in 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. To the maximum extent feasible, factory mix paint materials to correct color, gloss, and consistency for application. EVR-Gard Coatings products are specified herein except as otherwise noted, to establish types and qualities. The following Paints are District standard colors for all schools except as noted in the drawings:
   1. Exterior Walls: Scotch (Evr-Gard) Dusty Taupe
   2. Exterior Trim: Scotch (Evr-Gard) Horizon Blue
   3. Interior Walls: Scotch (Evr-Gard) Pearl White #70
   4. Other Scotch (Evr-Gard) colors as designed for a particular school and as specified in the drawings, with prior approval by Administrator/Facilities Planning, Development and Support Operations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Inspect surfaces to receive paint finish **for surface blemishes and repair as required**. Surfaces that are not properly prepared or sandpapered or cleaned or which are not in condition to receive the specified finish, shall be corrected, before priming is done. **Wash and rinse walls and trim with T.P.S. before applying any primer**. No priming shall be done until District IOR **or the Owner's representative approves the surfaces**.

B. Protect floors and all adjacent surfaces from paint smears, spatters, and accidental droppings. Cover fixtures and remove hardware not to be painted. Mask off areas where necessary. **Any accidental spills, over-painting or spatters shall be cleaned up immediately before additional work proceeds.**

   Hardware: Insure that hardware is removed before painting is started and replaced only when paint finishes are thoroughly dry.

   1. Removal and reinstallation of hardware is specified in Section 06200--Finish Carpentry and Millwork.

   2. Items to be removed include, without limitation: Signs and graphics; switch and receptacle plates; escutcheons and plates; all surface-mounted equipment; free-standing equipment blocking access; grilles and louvers at ducts opening into finished spaces; **all tape on doors, walls or other District property**; and other items as required and directed.

C. Woodwork shall be thoroughly cleaned, hand sandpapered parallel to the grain, and dusted off. Nail holes, cracks or defects in all work shall be carefully puttied. **Caulk all woodwork joints with specified caulking. Wash and rinse trim with T.S.P. both before applying any primer**. On stained woodwork the putty shall be colored to match the stain. Puttying shall be done after the first coat of paint, shellac or varnish has been applied.

D. Gypsum board: Remove all foreign matter. Fill all pits flush and smooth with spackle. **Wash and rinse Gypsum board walls with T.S.P. before applying any primer.**

E. Plaster surfaces shall be allowed to dry at least 3 weeks before painting, or plaster shall be allowed to dry sufficiently to receive paint as determined by moisture meter tests. Clean off dirt, dust, excess mortar, encrustation and foreign matter. Fill holes, pits and other imperfections flush and smooth**. Wash and rinse Plaster walls with T.S.P. before applying primer.**

F. Concrete Surfaces shall be dry, cleaned of dirt and foreign materials and in proper condition to receive paint. Neutralize spots showing effects of alkali.

G. Metal surfaces to be painted shall be thoroughly cleaned of rust, corrosion, oil, foreign materials, blisters, and loose paint removed to bright metal. **Apply the metal paint preparation coating recommended by the paint manufacturer prior to applying the primer. All shop and field painted metal shall follow these procedures.**

H. Surfaces Not Mentioned: Prepare surfaces according to recommendations of the paint manufacturer and as approved **by the Architect or the Owner.**

I. Do not apply painting materials to wet, damp, dusty, dirty, fingermarked, rough, unfinished, or defective surfaces.

J. Bond breakers and curing agents must be removed and the surface cleaned, **as specified is section 3.01-A above**, before primers, sealers or finish paints are applied.

3.02 APPLICATION

A. General: Employ experienced painters supervised by a foreman with a minimum of 5 years' experience in public works projects, thoroughly familiar with code requirements, and the best recommendations of the painting materials manufacturer. Utilize the following methods and procedures:

1. Apply material evenly, free from sags, runs, crawls, holidays or defects. Mix to proper consistency, brush out smooth, leaving minimum of brush marks, enamel uniformly flowed on. Sand between enamel coats.

2. **Apply paint by brushes, rollers or spray except rollers shall not be used on wood surfaces or on wood floors. If rollers are used on other surfaces, then all surfaces shall be brushed out by hand. Spraying is not permitted on wood floors. Paint wood floors by using a hand brush, applying the paint at the specified application rate as recommended by the manufacturer. Apply in thin coats allowing proper drying time between coats. The use of two ventilation fans is required in each room to accelerate the drying of the floors. One fan in the door pushing air into the room and one fan in a window exhausting air out of the room. Keep fans running until all paint fume smells and non-existence in the rooms**.

3. Tint all pigmented undercoats to approximately same shade as final coat. Perceptibly increase the depth of shade in successive coats.

4. Allow each coat to thoroughly dry before succeeding coat application, a minimum of 24 hours. Sand between enamel coats.

5. Finish all four edges of doors with the same number and kind of coatings as specified for their main surfaces **on all new or reused doors**. Where opening into rooms have different finishes, finish door edges to match the side into which it swings. **The top of all doors that open to the outside shall have a continuous painted top coating to prevent moisture from penetrating the door material**.

6. Finish mill or shop primed items with materials compatible with prime coat.

7. Mechanical and electrical work shall be cleaned, pretreated and painted with 3 coats or as noted:

   a. Paint that portion of ductwork or plenum spaces, the interior of which is visible through the grilles: they shall be pretreated and painted with 2 coats of flat black paint.

   b. Shop primed metal surface of all mechanical and electrical equipment shall receive two finish coats of paint to match adjoining wall or ceiling surfaces. Prime coat, in addition to above, on all unprimed surfaces.

   c. All other mechanical and electrical equipment exposed to view, such as covered and uncovered piping and ductwork, **supports for piping and ductwork**, pumps compressors, air conditioning equipment, tanks, etc., shall be painted as specified herein, where not supplied finished under other sections.

8. Miscellaneous painting: Surfaces to be painted and not specifically described herein shall be painted with a product specifically manufactured or prepared for the material and surface; prime coat and two finish coats and **subjected to all the conditions previously mentioned above governing painting.**

B. Back-painting: Immediately upon delivery to the building, exterior finish lumber and millwork shall be back-painted on surfaces that will be concealed after installation. Items to be painted shall be back-painted with the priming coat specified under "Priming".

C. Priming: Wood and metal surfaces specified to receive paint finish shall be primed **as specified in section 3.01.** 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. Galvanized metal work, and interior and exterior woodwork shall be primed immediately after erection. Priming of surfaces and priming coat shall be as follows and as specified in schedule:

1. Knots, Pitch and Sap Pockets: Shellac, or approved equivalent, before priming.

2. Exterior Woodwork: Prime with one coat of exterior water borne emulsion wood primer.

3. Interior Woodwork: Where indicated to be painted, prime with one coat of water borne 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. **Apply the recommended muratic acid etching solution and thoroughly wash metal. Apply pretreatment coating and follow manufacturer's instructions for drying time, and then prime with one coat of metal primer as specified in section 3.01.**

6. Unprimed Iron, Steel, and Other Uncoated Metals: Where specified to be painted, prime with one coat of metal primer **as specified in section 3.01..**

7. Shop Primed Metal Items: **Metal** shall be primed **as specified in section 3.01** and touch up bare and abraded areas with metal primer prior to application of second and third coats.

D. The number of paint coats specified to be applied are **the minimum required**. Apply additional coats if required to obtain complete coverage and approved results. Ensure acceptable paint finishes of uniform color, free from cloudy or mottled areas and evident thinness on arises. "Spot" or undercoat surfaces as necessary to produce such results. Conform to the approved Samples. Obtain approval of each coat before applying next coat**. If this inspection step is missed**, apply an additional coat over entire surface involved at no additional contract cost.

E. Each coat of painted woodwork and metal, except the 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 applied.

F. Each coat of paint or enamel shall be a slightly different shade as directed. The District Inspector will inspect each coat of paint, enamel, stain, shellac, and varnish before the next coat is applied. Notify the District Inspector that such work is ready for inspection**. If this inspection step is missed, apply an additional coat over entire surface involved at no additional contract cost.**

G. Do not "paint-out" underwriters' labels, fusible links, sliding surfaces and identification stamps on any new or existing materials, equipment, or structures.

H. Damaged shop prime coat shall be touched-up with metal primer prior to application of second and third coats.

I. Apply each coat of material to the manufacturers recommended dry film thickness and spread rate.

3.03 CLEANING

A. Remove rubbish, waste and surplus material and clean woodwork, hardware, floors and other adjacent work.

B. Remove paint, varnish and brush marks from glazing material and, upon completion of the painting work, wash and polish the glazing material both sides. Glazing material that is damaged shall be removed and replaced with new material at no cost to the District.

C. Clean hardware and other unpainted metal surfaces with manufacturer's approved cleaner. Do not use abrasives or edged tools.

D. Leave paint storage spaces clean and in condition required for equivalent spaces in the project. **Specified shelf stock shall consist of new unopened paint containers and shall be turned over to the District per the contract documents.**

3.04 SCHEDULE – Refer to District to provide **Trim** colors by site. **All base bids shall include Scotch Coatings) paint as the District Standard.**

A. Exterior.

1. Concrete, Plaster.

Scotch Coatings – (EV) 7509 water base with semi-gloss EV 700 walls;

2. Ferrous metal.

Scotch Coatings – Ellis 4482 (oil base); Ellis 7962 (waterborne)
First coat: Scotch Coatings – Ellis 4482 Rust Inhibitor primer
Second Coat: Ellis 7962 Primer All
Third coat: Scotch Coatings - EV 700

3. Galvanized metal.

Pretreat: Ellis 688 Galva-Etch and Prep
First Coat: Ellis 1262 Primer All
Second coat: Ellis 1262 Primer All
Third Coat (gloss): Scotch – EV 8000

4. Wood (pigmented)

Scotch Coatings – Scotch Coatings:
First coat: Scotch Coatings 300
Second and third coats (gloss): EV 700, EV8000

B. Interior.

1. Gypsum drywall.

Scotch Coatings – Scotch-Gard coatings:
First coat: EV 78 Sealer
Second and third coats: EV 500; EV 700

2. Wood Doors.

Scotch Coatings - Scotch-GARD coatings:
First coat: EV 78
Second and third coats (semi-gloss): EV700

3. Door Frames.

Scotch Coatings – Scotch-Gard coatings:
First coat: Ellis 4482
Second coat: EV 599
Third coat: EV 8000

4. Metal Trim:

Scotch Coatings – Scotch-Gard coatings:
First coat: EV 688 Galva etch
Second coat: Ellis 1262 primer

Third coat: EV 8000

5. Wood Trim:
First coat: EV 78
Second coat: EV500
Third coat: EV 8000

6. Wood Floors:

Scotch Coatings: Consult Burbank Paints Representative

7. Cement Masonry Units:

Scotch Coatings –Scotch-Gard coatings:
First coat: EV 7509
Second coat: EV 500
Third and Fourth coats: EV 8000

8. Mechanical and Electrical Work:

a. 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.

First: As specified under Priming.

Second and Third: Interior enamel, semi-gloss or gloss to match adjacent wall or ceiling finish.

b. Insulation and Taping on Pipes and Ducts: 3 coats.

1. Finished Rooms:
First: Interior water borne primer.
Second and Third: Interior semi-gloss or gloss enamel to match adjoining wall or ceiling finish.

2. On Building Exterior:
First Exterior water borne primer.
Second and Third: Exterior gloss enamel.

c. 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.

9. Anti-Graffiti Coating:

a. Shall be Life-Deck, 4001 Clear Gloss, from Burbank Paints.

b. Waterborne: A solids sealer, water soluble, should conform to Scotch-Scotch-Gard from Burbank Paints.

END OF SECTION

EXECUTION

4.01 USE OF PREMISES

A. CONTRACTOR shall coordinate Work of all trades, Subcontractors, utility service providers, with OWNER and/or Separate Work Contract. CONTRACTOR shall sequence, coordinate, and perform the Work to impose minimum hardship on the operation and use of the existing facilities and/or Project site. CONTRACTOR shall install all necessary protection for existing improvements, Project site, property, and new Work against dust, dirt, weather, damage, vandalism, and maintain and relocate all protection to accommodate progression of the Work.

B. CONTRACTOR shall confine entrance and exiting to the Project site and/or facilities to routes designated by the DISTRICT

C. Within existing facilities, OWNER will remove portable equipment, furniture, and supplies from Work areas prior to the start of Work. CONTRACTOR shall cover and protect remaining items in areas of the Work

D. CONTRACTOR is advised school may be in session during performance of the Work. CONTRACTOR shall utilize all available means to prevent generation of unnecessary noise and maintain noise levels to a minimum. When required by the DISTRICT, CONTRACTOR shall immediately discontinue noise-generating activities and/or provide alternative methods to minimize noise generation. CONTRACTOR shall install and maintain air compressors, tractors, cranes, hoists, vehicles, and other internal combustion engine equipment with mufflers, including unloading cycle of compressors. CONTRACTOR shall discontinue operation of equipment producing objectionable noise as required by the DISTRICT.

E. CONTRACTOR shall furnish, install, and maintain adequate supports, shoring, and bracing to preserve structural integrity and prevent collapse of existing improvements and/or Work modified and/or altered as part of the Work.

F. CONTRACTOR shall secure building entrances, exits, and Work areas with locking devices as required by the DISTRICT.

G. CONTRACTOR assumes custody and control of OWNER property, both fixed and portable, remaining in existing facilities vacated during the Work.

H CONTRACTOR shall cover and protect surfaces of rooms and spaces in existing facilities turned over for the Work, including OWNER property remaining within as required to prevent soiling or damage from dust, dirt, water, and/or fumes. CONTRACTOR shall protect areas adjacent to the Work in a similar manner. Prior to OWNER occupancy, CONTRACTOR shall clean all surfaces including OWNER property.

I. CONTRACTOR shall not use or allow anyone other than OWNER employees to use facility telephones and/or other equipment, except in an emergency. CONTRACTOR shall reimburse OWNER for telephone toll charges originating from the facility except those arising from emergencies or use by OWNER employees.

J. CONTRACTOR shall protect all surfaces, coverings, materials, and finished Work from damage. Mobile equipment shall be provided with pneumatic tires.

K. CONTRACTOR is advised OWNER will award Separate Work Contracts at this Project site.

L. CONTRACTOR shall not permit the use of portable and/or fixed radio's or other types of sound producing devices including walk mans and similar devices.

4.02 PROPERTY INVENTORY

A. Property, OWNER intends to remove; will be removed by OWNER before a room or space is vacated for the Work. Before performing Work in each room or space, DISTRICT and CONTRACTOR shall prepare a detailed initial written inventory of OWNER property remaining within, including equipment and telephone instruments and the condition thereof. DISTRICT and CONTRACTOR shall retain a signed copy of the inventory dated and signed by both parties. Prior to subsequent OWNER occupancy of each such room or space, DISTRICT and CONTRACTOR shall perform a final inventory of OWNER property and all discrepancies between the initial inventory and final inventory shall be the responsibility of CONTRACTOR.

4.03 FURNITURE, FIXTURES AND EQUIPMENT (MATERIALS) OWNER FURNISHED CONTRACTOR INSTALLED (OFCI)

A. Certain materials identified in the Contract Documents as OWNER Furnished CONTRACTOR Installed, OFCI, will be delivered to the Project site by the OWNER.

B. If designated in the Contract Documents to be OWNER furnished CONTRACTOR installed, (OFCI), and **CONTRACTOR** shall unload, store, uncrate, assemble, install, and connect OWNER supplied materials.

C. Forty Eight (48) hours before the date the CONTRACTOR needs to have the OFCI materials on site, CONTRACTOR shall notify OWNER of the scheduled date for needed OFCI materials. Upon delivery to Project site, CONTRACTOR shall store OFCI materials inside rooms and/or protected spaces and will be responsible for security of OFCI materials until Substantial Completion. DISTRICT will sign receipt or bill of lading as applicable.

D. CONTRACTOR shall, within one (1) day after delivery, uncrate and/or unpack OFCI materials in presence of OWNER who shall inspect delivered items. OWNER shall prepare an inspection report listing damaged or missing parts and accessories. OWNER shall transmit one (1) copy of the report to CONTRACTOR. OWNER will procure and/or replace missing and or damaged OFCI materials, as indicated in inspection report.

E. CONTRACTOR shall install OFCI materials in the locations and orientation as indicated in the Contract Documents. CONTRACTOR shall verify exact locations with DISTRICT before final installation of OFCI materials.

F. If required, DISTRICT will furnish setting and or placement drawings for OFCI materials.

G. CONTRACTOR shall install OFCI materials by proper means and methods to ensure an installation as recommended by the manufacturer. CONTRACTOR shall furnish and install all necessary fasteners and required blocking to properly install OFCI materials.

H. CONTRACTOR shall install OFCI materials with manufacturer recommended fasteners for the type of construction to which the OFCI materials are being fastened and/or anchored.

I. CONTRACTOR shall provide final connections of any electrical, signal, gas, water, waste, venting and/or similar items to OFCI materials. CONTRACTOR shall, prior to final connection, verify the operating characteristics of OFCI materials are consistent with the designated supply.

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

k. 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

L. 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.

4.04 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 9 – GENERAL NOTES

5.01 GENERAL NOTES

A. Work areas and detailed scope of work are shown under PART 2.01.

B. It is the responsibility of the contractor to examine the site of the work and after investigation to decide for himself the character of materials, equipment and utilities to be encountered and all other conditions affecting the work. It is also his responsibility to provide sufficient costs to cover the provisions of all items of work under the existing conditions referred to herein.

C. CONTRACTOR is responsible to review the AHERA – Inspection reports for any presence of asbestos containing materials (ACM). CONTRACTOR shall immediately notify OWNER of the presence or suspected presence of any ACM found during the course of the work, prior to the disturbance of the subject materials. At the sole direction of the OWNER, contractor may be required to stop all work on all or any portion of the project until ACM materials are properly abated by OWNER.

C. All work areas have available access. The Contractor will be issued keys for the sites through the District Facilities and Support Operations Department to allow access at the sites. Contractor will ensure they secure all areas that are accessed by their personnel to ensure the security of the site.

D. Contractor shall provide trash bins and storage facilities for use at the site. The contractor shall not use school facilities for these purposes. It will be the contractor's responsibility to maintain and keep those facilities neat and clean at all times.

E. There may be other contractors or District workers working at the job site. Contractor will be responsible to coordinate his work with their schedules.

F. The Representative will have the right to stop the work immediately in case he sees a discrepancy or work not following the specifications. The contractor will not be let to continue to work until corrections are made and approval and permission given by the District Representative.

5.02 RESTRICTIONS

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the work areas in which the work is indicated. Allow for Owner occupancy and use by the public.

B. Use of the Existing Buildings: Repair damages caused by construction operations. Take all precautions necessary to protect the existing buildings and their occupants during the construction period.

C. Driveways and Entrances: Keep driveways and entrances serving the premises clear and available to the Owner, the Owner's employees, other contractors working, and emergency vehicles at all times.

D. Full Owner Occupancy: The Owner may occupy the site and existing buildings during the entire construction period. Cooperate with the owner during construction operations to minimize conflicts and facilitate owner usage. Perform the work so as not to interfere with the Owner's operations.

5.03 PERMISSIBLE WORKING DAYS AND HOURS

A. Work may be conducted as follows:

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. Subject to local ordinances, CONTRACTOR may work any hours on Saturdays, Sundays, and any non-school session days, when written notification to the District has been submitted and the anticipated schedule of work has been approved.

SECTION 01 74 10

CLEANING

PART 10 - GENERAL

10.01 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 10.2 - PRODUCTS

10.2.01 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 10.3 - EXECUTION

10.3.01 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. DO NOT USE SITE CONTAINERS.

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.

A. 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, or finished surfaces.

10.3.02
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 Flooring: Freshly wax and buff as specified in Section 09 65 00.

3. Wood Flooring: Remove defects and blemishes by sanding surface and painting according to Section 09 90 00.

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

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

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

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

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

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

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

11. Clean ducts, blowers and coils, if air conditioning units are found to have been operated without filters during construction, and after final inspection.

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

13. 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.

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

E. 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