PROJECT MANUAL

CAMARILLO HIGH SCHOOL
ALTERATION PROJECT

A#03-120049 FILE NO. 56-H4

4660 Mission Oaks Boulevard, Camarillo, California 93012

for

OXNARD UNION HIGH SCHOOL DISTRICT
309 South K Street (Building C)
Oxnard, California 93030

Flewelling & Moody
Project No. 2840.0100

FLEWELLING & MOODY

architects for education

CAMARILLO HIGH SCHOOL ALTERATION PROJECT
F&M 2840.0100
MAY 21, 2020

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SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

B. Related Section:

1. Division 01 50 00 Section "Temporary Facilities & Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Camarillo High School HVAC Project.

1. Project Location: 4660 Mission Oaks Blvd, Camarillo, CA 93012.

B. Owner: Oxnard Union High School District

1. Owner's Representative: ~~Paul Hanson~~. James Ketcham, Director, 805-385-5871

C. Architect: Flewelling & Moody.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

~~1. HVAC upgrades throughout campus.~~

~~2. Lighting upgrades at classroom buildings.~~

~~3. Window replacement at classroom buildings.~~

~~4. Path of travel improvements~~

SCOPE:
Installation of owner furnished dust collector (OFCI). Include all associated work including ductwork and electrical connections all of which are CFCI per the DSA approved CCD #27.

B. Type of Contract.

1. Project will be constructed under Design – Bid – Build.

Unimaster Dust Collector to be OFCI.

1.4 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, storm water detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.

2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.5 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will partially occupy the premises during entire construction period. Adjacent site is commercial and residential area. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.

2. Provide not less than 72 hour notice to Owner of activities that will affect Owner's operations.

B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.

4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours as regulated by ~~the City of Camarillo.~~ 07am to 5pm, Monday thru Friday, per Oxnard Union HS District

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.

2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less thar five days in advance of proposed disruptive operations.

2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Nonsmoking Campus: Smoking is not permitted within the campus.

F. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 10 30
PROJECT PROCEDURES

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: This section establishes special project procedures regarding

1. Documents and bid procedures;
2. Protection of existing facilities;
3. Limits of work and storage areas;
4. Construction controls;
5. Coordination;

1.2 QUALITY ASSURANCE

A. Perform all work in strict accordance with pertinent requirements of these Specifications and, in the event no such requirements are determined, in conformance with the Architect's written direction.

1.3 SUBMITTALS

A. Coordinate with Owner's Representative on a detail for duct penetration through window. Detail shall address moisture, wind and dust penetration prevention.

PART 2 – PROD

2.1 GENERAL

A. It is the intent of these Specifications and other Contract Documents to provide a complete workable design in all parts; any equipment shown or specified shall be furnished and installed with all accessories, controls, power, and full connections as may be necessary to assure safe and proper installation and operation.

2.2 PRECEDENCE

A. The Contract and each of the Contract Documents are complementary and they shall be interpreted so that what is called for in any one shall be as binding as if called for in all.

B. If there is a conflict between these Technical Specifications and any remaining portion of the bid, the provisions requiring the most expensive or elaborate method of work, materials, or equipment shall control. Items in direct conflict, discovered during the bid, should be brought to the attention of the Architect, for clarification, by written Addenda. If clarification and/or Addenda is unable to be issued, the bidders shall bid the more expensive of the conflicting items/conditions; this provision shall govern the entire scope of this contract. Following Award of Bid, should the District elect to utilize the cheaper or less elaborate condition, a credit change Order shall be issued. Refer to related information in the General and Special Conditions. Contractor shall secure written permission from Architect before proceeding with work affected by omission or discrepancies in the Contract.

C. Separate sections of this Specification are arranged only for convenience of Contractor, and nothing stated herein should be misconstrued as suggesting jurisdiction over items of work by any different building trades.

D. When Agreement is signed, the Contractor will be given copies of the Architect's original plans and CAD disk to make one (1) set of reproducible sepias and one (1) as-built CAD Disk, the cost to be funded by the Bidder's General Conditions. All drawing print sets required by the awarded firm, subcontractors and suppliers shall be included. This sepia and CAD disk set will also be used for the "as-built" drawings as referenced in Section 01720, Project Record Documents. A complete As-Built submission shall consist of the sepia's and the CAD disk.

PART 3 – EXECUTION

3.1 CARE OF PRESENT BUILDINGS AND GROUNDS

A. Contractor shall be held responsible, so far as his operations are concerned, for the care and preservation of the adjacent premises, utilities, walks, streets and co-terminus property. Any parts of them injured, damaged, or disturbed because of his work shall be repaired, replaced, or cleaned, at Contractor's expense, to the satisfaction of District Representative. Prior to commencement of the Work, the Contractor or his designated representative shall jointly review the site as a part of the Pre-Construction Conference.

B. Any such facilities as existing roads, curbing, utility poles, or underground utility lines damaged by Contractor in execution of this Contract shall be restored to former condition by Contractor at no change in the Contract price to satisfaction of District.

C. Contractor shall take all precautions and care to preserve and protect all trees and shrubs in the right-of-ways and on the property. No tree or trees shall be cut or felled without specific permission in writing from the Architect. Trees cut without explicit instructions do so shall be replaced at the expense of the Contractor.

D. No pruning of trees is to be done except by specified instructions of the District. Soil within the spread of the tree branches shall not be disturbed.
Advance notice shall be given to the District if roots of a diameter greater than 1" must be cut.

E. Contractor shall record and submit to District for verification any damage prior to commencement of work. Any damage not recorded and verified by District is the responsibility of the Contractor to correct.

3.2 LIMITS OF WORK AND STORAGE AREAS

A. Submit for Construction Manager's approval a site utilization plan for construction. Plans shall indicate limits of work, storage areas, and truck routes.

3.3 CONSTRUCTION CONTROLS

A. Dust palliation: In addition to cleanup provisions of the Specifications, Contractor shall take appropriate steps during and throughout term of the Project to prevent airborne dust due to work under this Contract. Water shall be applied to settle and prevent dust, particularly during excavation and moving of materials. No chemical palliatives shall be used without permission of the District.

B. Noise control: Noise from job equipment shall be kept to a minimum by adequate mufflers and other means as approved by Architect or Construction manager.

C. Interruptions of existing services shall be held to minimum and shall be made only at such times as the District directs. Approval of the District shall be requested at least 3 days in advance of desired interruption time. **Contractor shall be responsible for full Utility service to be maintained at all times to the adjacent buildings.**

3.4 SPECIAL COORDINATION REQUIREMENT

A. It is possible that the District might have various projects under different contracts in progress simultaneously in areas adjacent to, or coincident with, areas involved in the Project.

B. Contractor shall be responsible to coordinate the work with that of other contractors' work to allow access to sites and to avoid rework and damages to new work.

C. Contractor shall submit a detailed critical-path schedule for District's approval before beginning work and shall make such changes in this schedule as required by District in order to assure smooth and proper execution of all works.

3.5 VERIFICATION OF EXISTING UTILITIES

A. Prior to constructing any new underground utility the Contractor shall expose and verify all existing underground facilities that may conflict with the new utility, to ensure accuracy of the information shown on the Drawings.

3.6 HAZARDOUS MATERIALS

A. Should asbestos, PCB or other hazardous materials be encountered in any area, immediately stop all work in that area and notify the District's representative; the District will remove all hazardous material, clean the area, and have it certified as safe by a Certified Industrial Hygienist before work under this contract may proceed in that area. A time extension will be granted for delay caused by this cleanup.

B. Non-Specified asbestos removal from buildings shall be done under separate contract by the District.

3.7 ADDENDA AND CHANGE ORDER

A. Changes in the Plans and Specifications shall be made be Addenda and Change Orders approved by the Division of the State Architect. Minor modifications, as determined by the District, may be made to the Plans and Specifications in writing accompanied with the Architect's signature without the processing of a formal Change Order.

3.8 ACCESS PANELS

A. Access panels are referenced in separate sections for different trades (mechanical, plumbing, electrical). It shall be the responsibility of the individual trades to provide the access panels (sized accordingly) required for their installations. Coordinate exact location with Construction Manager prior to installation.

3.9 FIRESAFETY DURING DEMOLITION

A. Demolition of buildings shall be in accordance with Section 8706 and, where applicable, Sections 8704 and 8705 of the California Fire Code, most recent addition.

B. Suitable fire hose, shall be maintained at the demolition site. Such hose shall be connected to an approved source of water and shall not impede fire department use of hydrants.

C. Demolition operations involving cutting and welding shall be in accordance with Section 4907, C.F.C.

D. Combustible waste material, trash and rubbish shall not be burned at the demolition site, unless approved. Accumulations of such material shall be removed from the site as often as necessary to minimize the hazards therefrom.

D. When required by the District, for building demolition which is hazardous in nature, qualified personnel shall be provided to serve as on-site fire watch. The sole duty of fire watch personnel shall be to watch for the occurrence of fire.

3.10 FIRE SAFETY DURING CONSTRUCTION

A. Buildings under construction shall be in accordance with Section 8704 of the California Fire Code, most recent edition.

B. Fire department access roads shall be established and maintained in accordance with Section 902, C.F.C.

C. Water mains and hydrants shall be installed and operational in accordance with Section 903.

D. During the construction of a building and until the permanent fire-extinguishing system has been installed and is in service, fire protection shall be provided in accordance with Section 8704, C.F.C.

E. Fire extinguishers shall be provided for the buildings under construction. The number and type of extinguishers and the type of extinguisher shall be suitable for the type of fire associated with the hazards present.

F. Combustible Debris. Combustible debris shall not be accumulated within buildings. Combustible debris, rubbish and waste material shall be removed from building as often as practical. Combustible debris, waste material and trash shall not be burned on the site unless approved.

G. Internal-combustion-powered construction equipment shall be used in accordance with the following:

1. Equipment shall be located so that exhausts do not discharge against combustible material.

2. When possible, exhausts shall be piped to the outside of the building.

3. Equipment shall not be refueled while in operation.

4. Fuel for equipment shall be stored in an approved area outside of the building.

H. Temporary heating devices shall located away from combustible materials, and attended and maintained by competent personnel.

I. Smoking shall be prohibited. A suitable number and type of NO SMOKING signs shall be posted.

J. Cutting and welding operations shall be in accordance with Article 49, C.F.C.

K. The use of torched or flame-producing devices for the sweating of pipe joints shall be in accordance with Section 1109.3.2, C.F.C.

M. The storage, use and handling of flammable liquids shall be in accordance with Article 79. Ventilation shall be provided for operation utilizing the application of materials containing flammable solvents.

N. Open-flame devices and other sources of ignition shall not be located in areas where flammable materials are being used.

O. Asphalt and tar kettles shall be located and operated in accordance with Section 1105, C.F.C.

P. Temporary electrical wiring shall be in accordance with Section 8503, C.F.C.

Q. When required by the chief, access to buildings for the purpose of fire-fighting shall be provided. Construction material shall not block access to buildings, hydrants or fire appliances.

R. Telephone facilities shall be provided at the construction site for the purpose of emergency notification of the fire department. The street address of the construction site shall be posted adjacent to the telephone together with the fire department telephone number.

S. A fire-protection plan shall be established by the Shell, Electrical and HVAC Contractors for each school site

3.11 REQUESTS FOR INFORMATION AND OTHER OFFICIAL CONTRACT CORRESPONDENCE

A. Requests for Information (and/or Clarification) (hereinafter referred to as “RFI’s”) submitted by the Contractor to the District shall contain the following:

1. Sequential RFI number.

2. Date.

3. Project Title and Information.

4. Statement whether sent via facsimile only and/or hard copy to follow. It is acceptable to send a facsimile copy only; it is acceptable for the District to send a facsimile response only.

5. Addressed to the District.

6. Plan Sheet Reference and/or Spec. Section Reference including additional detail as required, such as column grid reference, or Part/Paragraph section of the Specification.

7. Bold Reference citing the “Description of the Scope in Question” such as: “Ceiling Height in Classroom B123, Duct Clearances”.

8. A complete, concise question regarding the issue. Note: If sketches, or other documentation, are attached, a reference shall be provided alluding to these attachments. If the RFI is originated from a subcontractor, this shall be noted.

9. The date the answer is needed by so as not to impact schedule. Note: The Contractor shall allow a minimum of 5 working days for each RFI.

10. If a “yes” answer, or some such similar answer, would impact the contract schedule, this shall be noted.

11. If there is a potential cost/credit impact to the District's answer, this shall be noted. Failure to notify the Construction manager at the time of the RFI may waive the Contractor's rights to such future claim.

12. The signature of the Contractor or Contractor's superintendent.

13. An area with printed lines for the District's response.

14. A space for the Project Manager's signature and date.

15. The Contractor's field office facsimile number printed on the RFI.

B. The Contractor shall not submit more than six (6) RFI's in any one day, or more than twenty-four (24) RFI's in any one working week. It shall be the Contractor's responsibility to study the plans and specifications, in conjunction with his subcontractors, far enough in advance to submit the RFI's so as to not have an adverse impact upon the project sequencing or schedule.

C. The Construction Manager shall be responsible for the distribution of all RFI's, once they have been answered by the Architect, in an appropriate and final manner, to all applicable trade contractors. The Architect shall make initial distribution to the District, Inspector of Record, Construction Manager, as well as to her own consultants and engineers.

D. The Construction Manager shall maintain an RFI log, and distribute the log, showing current status at each project meeting. The Construction Manager shall maintain a bound file of all the RFI's, with the District's response, including all applicable attachments, in the job trailer at all times during the project.

1. When applicable, all Contractors shall attach an RFI response to the Master Project Construction Set, at the appropriate location in the plans and/or specifications, if the answer affects, revises, or provides necessary clarification to the construction issue in question.

E. Proposal Requests: When the Contractor has notified the Construction Manager that the response is generating either a potential cost or credit to the contract, the Construction Manager shall issue a proposal request to the Contractor, and copy all applicable parties.

1. When the costs and/or credits have been submitted properly for the work in question, and have been reviewed by the District and Construction Manager, and the cost(s) and/or credits have been agreed upon, the Construction Manager will then assign the item to the next change order in the billing cycle.

F. Frivolous RFI's: The RFI format shall not be used for the following:

1. A method for getting the Construction Manager or Architect to perform the Contractor's duties of properly reviewing and coordinating the plans and specifications. The Contractor is asked to use discretion in submitting RFI's; simple questions can be solved by teleconference with the Construction Manager, or bringing up questions at the weekly meetings. The Construction Manager will work with the Contractor in defining what constitutes the difference.

2. The method for getting the District to answer a subcontractor's question that normally is part of the trade bid Contractor's responsibility.

3. A method for attempting to create additional cost to the contract where no additional cost is due.

4. A method for luring to District into providing an answer clearly different than the documents require.

5. In the event that the Contractor is deemed to be abusing the RFI process, the Construction Manager reserves the right to "back-charge" the contract, per his standard hourly rates, as a credit in dollars to be applied to contract extra costs.

G. Status of District's Responses to RFI's: The Architect's written response, when applicable, shall be incorporated into the contract as the most current ruling or interpretation of the plans and specifications.

H. Bulletins: "Bulletins" issued by the Architect, whether or not generated by an RFI, shall become official contract correspondence and incorporated into the contract. If necessary, and subject to the agreement of all parties, Bulletin issues may lead into a Proposal Request and Change Order.

END OF SECTION

SECTION 01 10 45
CUTTING AND PATCHING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section establishes general requirements pertaining to cutting (including excavating), fitting, and patching of the Work required to:

1. Make the several parts fit properly;

2. Uncover work to provide for installing, inspecting, or both, of ill-timed work;

3. Remove and replace work not conforming to requirements of the Contract Documents; and

4. Remove and replace defective work.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

2. In addition to other requirements specified, upon the District's request uncover work to provide for inspection by the District of covered work, and remove samples of installed materials for testing.

3. Do not cut or alter work performed under separate contracts without the District's written permission.

1.2 SUBMITTALS

A. Request for District's consent:

1. Prior to cutting which affects structural safety, submit written request to the Project Architect for permission to proceed with cutting.

2. Should conditions of the Work, or schedule, indicate a required change of materials or methods for cutting and patching, so notify the Project Architect and secure his written permission and the required Change Order prior to proceeding.

B. Notices to the Architect:

1. Prior to cutting and patching performed pursuant to the District's instructions, submit cost estimate to the Architect. Secure the Project Architect approval of cost estimates and type of reimbursement before proceeding with cutting and patching.
2. Submit written notice to the Project Architect designating the time the Work will be uncovered, to provide for the District's observation.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

PART 2 – PRODUCTS

2.1 MATERIALS

A. For replacement of items removed, use materials complying with pertinent Sections of these Specifications.

2.2 PAYMENT FOR COSTS

A. The Owner will reimburse the Contractor for cutting and patching performed pursuant to a written Change Order, after claim for such reimbursement is submitted by the Contractor. Perform other cutting and patching needed to comply with the Contract Documents at no additional cost to the Owner.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.

2. After uncovering the work, inspect conditions affecting installation of new work.

B. Discrepancies:

1. If uncovered conditions are not as anticipated, immediately notify the Architect and secure needed directions.

2. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide required protection including, but not necessarily limited to, shoring, bracing, and support to maintain structural integrity of the Work.

3.3 PERFORMANCE

A. Perform required excavating and backfilling as required under pertinent other Sections of these Specifications and OSHA standards for such work.

1. Perform cutting and demolition by methods which will prevent damage to other portions of the Work and provide proper surfaces to receive installation of repair and new work.

2. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.

3. Typically chip back existing adjoining plaster surfaces to expose the lath and building paper to permit proper lapping on new infill materials.

END OF SECTION

SECTION 01 10 60
REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. This Section sets forth certain codes and standards and relevant requirements applicable to the work required under this contract.

1.2 STATUTORY AND JURISDICTIONAL REGULATIONS

A. State of California Code of Regulation and Amendments:

1. Title 24 – Industrial Relations; Safety Orders.

2. Current Federal ADA Guidelines

3. 2016 Building Standards Administrative Code, Title 24 C.C.R.

4. 2016 California Building Code (CBC), Title 24 C.C.R.; (2015 International Building Code of the International Code Council, with California Amendments)

5. 2016 California Electrical Code (CEC), Title 24 C.C.R.; (2014 National Electrical Code of the National Fire Protection Association, NFPA with California Amendments)

6. 2016 California Mechanical Code (CMC), Title 24 C.C.R.; (2015 IAPMO Uniform Mechanical Code with California Amendments)

7. 2016 California Plumbing Code (CPC), Title 24 C.C.R.; (2015 Edition IAPMO Uniform Plumbing Code with California Amendments)

8. 2016 Energy Code (CEC), Title 24 C.C.R.

9. 2016 California Historical Building Code, Title 24, C.C.R

10. 2016 California Fire Code (CFC), Title 24, C.C.R. (2015 International Fire Code of the International Code Council with California Amendments)

11. 2016 California Existing Building Code, Title 24 C.C.R (2015 International Existing Building Code of the International Code Council with California Amendments)

12. 2016 California Green Building Standards Code (CalGreen) Title 24, C.C.R

13. 2016 California Referenced Standards Code, Title 24, C.C.R.

14. 2016 California Public Safety, State Fire Marshal Regulations, Title 19, C.C.R.

B. List of Applicable NFPA Standards:

1. NFPA 253 Critical Radiant Flux of Floor Covering Systems 2015 Edition
2. NFPA 2001 Clean Agent Fire extinguishing Systems 2015 Edition

3. Reference code section for NFPA Standards – CBC (SFM) 3504.1

4.	NFPA 13	Automatic Sprinkler Systems	2016 Edition
5.	NFPA 14	Standpipe Systems	2016 Edition
6.	NFPA 24	Private Fire Mains	2016 Edition
7.	NFPA 25	Standard for Inspection, Testing & Maintenance of Water Based Fire Protection System	2017 Edition
8.	NFPA 72	National Fire Alarm Code (California Amended) (Note see UL Standard 1971 for “Visual Devices”)	2016 Edition
9.	NFPA 80	Fire Door & Windows	2016 Edition
10.	NFPA 105	Smoke & Draft Control Door Assemblies	2016 Edition
11.	NFPA 20	Stationary Pumps	2016 Edition
12.	NFPA 17	Dry Chemical Extinguishing Systems	2016 Edition
13.	NFPA 17a	Wet Chemical Systems	2017 Edition

C. Construction Safety

1. Statutory and jurisdictional requirements as applicable to temporary work, including California Construction Safety Orders.

2. Associated General Contractors of America, Inc., Manual of Accident Prevention.

3. OSHA, Occupational Safety and Health Agencies requirements.

1.3 GENERAL STANDARDS FOR WORK AND MATERIALS

A. Work or materials specified by reference to a number, symbol or title of a specific standard - - such as ASTM, U.L., F.S., or other standards - - shall comply with requirements thereof, except as limited to type, class, grade or modifications shown or specified.

B. Referenced standards shall have full force and effect as though printed herein and are not repeated for reasons that manufacturers and Contractors are assumed to be familiar with requirements governing or applicable to their work. Upon request, Architect will furnish information as to where copies may be obtained.

C. Material or trade associations, societies, or other bodies regularly publishing standards most widely used under these documents a\re listed herein together with reference symbols.

D. Individual standards are referred to under Technical Sections by said reference symbol followed by designation number.

A.A.	The Aluminum Association
AASHO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institution

AGA	American Gas Association
AISC	American Institute for Steel Construction
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
CS	Commercial Standards, U.S. Department of commerce
FGMA	Flat Gas Marketing Society
FML	Factory Mutual Laboratories
F.S.	Federal Specifications
GA	Gypsum Association
IEEE	Institute of Electrical and Electronic Engineers
MFMA	Maple Flooring Manufacturer's Association
M.S.	Military Specifications U.S. GSA
NAAMM	National Association of Architectural Metal Manufacturers
NBS	National Bureau of Standards
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
PCA	Portland Cement Association
PS	Product Standard, U.S. Department of Commerce
RIS	Redwood Inspection Service
SDI	Steel Door Inspections
SMANCA	Sheet Metal and Air Conditioning Contractor's National Association
TCA	Tile Council of America
UL	Underwriter's Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WIC	Wood Work Institute of California
WWPA	Western Wood Products Association

E. Book of Standards

1. State of California, Business and Transportation Agency, Department of Transportation.

   a. CALIFORNIA STANDARD SPECIFICATIONS: Standard Specifications, January 1988, specific parts referred to by Section number.

   b. CALIFORNIA TEST METHOD: Methods and Research Dept., Materials manual, 1988; specific tests referred to by California number.

2. APWA Standard Specifications: American Public Works Association, No. California Chapter, Standard Specifications for Public Works Construction, 2000 Edition; specific parts referred to by APWA Section number 3 U.L.; Underwriters' Laboratories Inc.; Buildings Materials List, 2001 or latest edition; and others regularly published; specific parts referred to by U.L. Classification Title and number.

1.4 FIRE RATED WORK OR MATERIAL

A. Applicable to materials, construction or fabrication specified or required to have limited fire hazard characteristics.

B. Materials or assemblies shall be tested and classified per applicable ASTM Test Methods; or comparable scientific testing establishing like valuations, under

sponsorship of manufacturer and conducted by U.L. or other established testing agency regularly performing tests of a type required.

1. Testing standards, methods and procedures shall be subject to approval by California State Fire Marshall hiving jurisdiction.

2. Flame spread of materials used, when installed under the conditions shown or specified, shall not exceed characteristic values specified.

3. Compliance shall be substantiated by written certificate, labeling or both as specified.

C. Wood: Refer to Division 6.

D. Electrical: Refer to division 16.

E. ASTM Tests not otherwise identified shall be listed under ASTM publication titled 2000 Annual Book of ASTM Standards, Section 00 under section of subject index, and under subject headings Fire Tests, and Flammability Tests.

1.5 MANUFACTURER'S STANDARDS

A. Applicable to type of items and products.

B. Instructions not otherwise shown or specified shall be those of producer, as applicable, covering:

1. Primary materials, auxiliary materials and accessories.

2. Conditions of handling and for storage and protection.

3. Preparation of backup surfaces.

4. Installation, cleaning and maintenance procedures.

C. Publications of procedures shall apply as particularly referred to, otherwise as regularly provided by producer, and shall include generalized installation publications or instructions.

END OF SECTION

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.

2. Requests for Information (RFIs).

3. Project meetings.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.3 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required obtaining the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.

2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.

4. Delivery and processing of submittals.

5. Progress meetings.

6. Pre-installation conferences.

7. Project closeout activities.

8. Startup and adjustment of systems.

9. Project closeout activities.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.

2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles,

door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.

2. Project number.

3. Date.

4. Name of Contractor.

5. Name of Architect.

6. RFI number, numbered sequentially.

7. RFI subject.

8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.

10. Field dimensions and conditions, as appropriate.

11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

12. Contractor's signature.

13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

C. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

   a. Requests for approval of submittals.

   b. Requests for approval of substitutions.

   c. Requests for coordination information already indicated in the Contract Documents.

   d. Requests for adjustments in the Contract Time or the Contract Sum.

   e. Requests for interpretation of Architect's actions on submittals.

   f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.

3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."

   a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Owner’s Project Manager in writing within **10** days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Owner’s Project Manager within seven days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly.

1. Project name.

2. Name and address of Contractor.

3. Name and address of Architect.

4. RFI number including RFIs that were dropped and not submitted.

5. RFI description.

6. Date the RFI was submitted.

7. Date Architect's response was received.

8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.6 PROJECT MEETINGS

A. General: Architect will schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.

2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner**,** and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than **15** days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, Contractor and its superintendent. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.

b. Phasing.

c. Critical work sequencing and long-lead items.

d. Designation of key personnel and their duties.

e. Procedures for processing field decisions and Change Orders.

f. Procedures for RFIs.

g. Procedures for testing and inspecting.

h. Procedures for processing Applications for Payment.

i. Distribution of the Contract Documents.

j. Submittal procedures.

k. Sustainable design requirements.

l. Preparation of record documents.

m. Use of the premises and existing building.

n. Work restrictions.

o. Working hours.

p. Owner's occupancy requirements.

q. Responsibility for temporary facilities and controls.

r. Procedures for moisture and mold control.

s. Procedures for disruptions and shutdowns.

t. Construction waste management and recycling.

u. Parking availability.

v. Office, work, and storage areas.

w. Equipment deliveries and priorities.

x. First aid.

y. Security.

z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's Project Manager, of scheduled meeting dates.

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

a. Contract Documents.

b. Options.

c. Related RFIs.

d. Related Change Orders.

e. Purchases.

f. Deliveries.

g. Submittals.

h. Review of mockups.

i. Possible conflicts.

j. Compatibility problems.

k. Time schedules.

l. Weather limitations.

m. Manufacturer's written recommendations.

n. Warranty requirements.

o. Compatibility of materials.

p. Acceptability of substrates.

q. Temporary facilities and controls.

r. Space and access limitations.

s. Regulations of authorities having jurisdiction.

t. Testing and inspecting requirements.

u. Installation procedures.

v. Coordination with other work.

w. Required performance results.

x. Protection of adjacent work.

y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.

4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.

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

D. Progress Meetings: Architect will conduct progress meetings at weekly intervals.

1. Attendees: Representative of Owner, Architect and Contractor. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.

2) Sequence of operations.

3) Status of submittals.

4) Deliveries.

5) Off-site fabrication.

6) Access.

7) Site utilization.

8) Temporary facilities and controls.

9) Progress cleaning.

10) Quality and work standards.

11) Status of correction of deficient items.

12) Field observations.

13) Status of RFIs.

14) Status of proposal requests.

15) Pending changes.

16) Status of Change Orders.

17) Pending claims and disputes.

18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 32 16
CONSTRUCTION SCHEDULE

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Construction Schedule procedures, preparation, submittal, updates, and revisions.

1.2 QUALITY ASSURANCE

A. Perform all work in strict accordance with pertinent requirements of these Specifications and in the event no such requirements are determined, in conformance with the Architect's written direction.

1.3 SUBMITTALS

A. The construction of this project will be planned and recorded with a conventional Critical Path Method (CPM) schedule. The schedule shall be used for coordination, monitoring, and payment of all work under the contract including all activity of subcontractors, vendors, suppliers, and for all submittals.

B. Contractor is responsible for preparing the schedule. All costs incurred by Contractor in preparing the schedule shall be borne by Contractor as a part of its responsibility under this contract.

1.4 PROCEDURES

A. Baseline Construction Schedule

1. Before proceeding with any work on site, Contractor shall prepare, submit, and receive District's approval of a Baseline Construction Schedule. This schedule shall provide a detailed breakdown of activities scheduled for the first 90 days of the project and shall include mobilization, submittals, procurement, and construction.

2. No contact work may be pursued at the site without an approved Baseline Construction Schedule or an approved CPM schedule.

B. Within forty five (45) calendar days after date of Notice to Proceed, Contractor shall submit, for review, a Detailed Project Schedule setting forth all requirements for complete execution of work.

C. Preparation of Detailed Project Schedule

1. The construction time, for the entire project or any milestone, shall not exceed the specified contract time. In the event that any milestone date or contract completion date is exceeded in the schedule, logic and/or time estimates will be revised.

2. Following the District's review, if revisions to the proposed schedule are required, the Contractor shall do so promptly. The schedule must be finalized within 60 days of the Notice to Proceed. Failure to finalize the schedule by that date will result in withholding all contract payments until the schedule is finalized.

D. Simultaneously with each submittal of Progress Payment Request, Contractor shall deliver to the District an updated Detailed Project Schedule reflecting work progress as of end of previous reporting period. Each such Schedule shall indicate actual progress to date in execution of work, together with a projected schedule for completion of work.

E. All Schedule submittals are subject to review and acceptance by the District. The District shall withhold progress payments until Contractor submits a Detailed Project Schedule acceptable to the District.

F. Concurrent with the District's acceptance of Contractor's submitted Detailed Project Schedule, shall be Contractor's signature of acceptance.

1.5 PREPARATION GUIDELINES

A. Work of this Contract shall be scheduled and progress monitored using a bar chart, although any of the CPM network type scheduling systems, including precedence diagramming or arrow are acceptable. Scheduling system shall show the sequence and interdependence of all activities required for complete performance of all items of work under this contract, including all approvals, shop drawings and other submittals and approvals, and fabrication and delivery activities. Scheduling system shall indicate all inter-relationships between trades and suppliers.

B. Level of detail indicated in schedule shall be equal to or greater than that provided by Table of Contents of Contract Technical Specifications, including any addenda. Duration and events indicated on schedule shall conform to phasing set forth in the Contract and shall show any area or building within a particular phase. Schedule shall indicate any and all Contract "milestone events" and other milestones agreed to by the District, but no other manually-imposed dates will be accepted unless approved.

C. Detailed Project Schedule shall represent a practical plan to complete work within time requirements of the Contract.

1. The Contractor may submit a Detailed Project Schedule depicting completion of the Work in a duration shorter than the Contract Time; provided that such Detailed Project Schedule shall not be a basis for adjustment to the Contract Price in the event that completion of the Work shall occur after the time depicted therein, nor shall such Detailed Project Schedule be the basis for any extension of the Contract Time.

2. A schedule found unacceptable by the District shall be revised by Contractor and resubmitted.

D. Detailed Project schedule shall clearly indicate sequence of construction activities, grouped by applicable phase and sorted by areas, buildings, or facilities within phase, and shall specifically indicate:

1. Start and completion of all items of work, their major components, and interim milestone completion dates, as determined by Contractor and the District.

2. Activities for procurement, delivery, installation of equipment, materials, and other supplies, including:

a. Time for submittals, re-submittals, and reviews. Include decision dates for selection of finishes, if applicable.

b. Time for fabrication, and delivery of, manufactured products for work.

c. Interdependence of procurement and construction activities.

d. As applicable, dates for testing, balancing equipment, and final inspection.

E. Schedule shall be in sufficient detail to assure adequate planning and execution of work.

1. Each activity shall range in duration no longer than two (2) weeks and shall be total of actual days required for completion, and shall include consideration of normal weather impact on completion of that activity.

2. The activities are to be described so that the work is readily identifiable and the progress of each activity can be readily measured. For each activity, Contractor shall identify the trade or subcontractor performing the work, the duration of the activity in work days, the manpower involved by trade, the equipment involved, the location of the work, and a dollar value of the activity. The dollar value assigned to each activity is to be reasonable and based on the amount of labor, materials, and equipment involved. When added together, the dollar value of all activities are to equal the contract price.

3. Schedule shall be suitable, in judgement of the Architect, to allow monitoring and evaluation of progress in performance of work; it shall be calendar time-scaled and, at a minimum, in a Bar Chart format.

4. Activities shall include:

a. Description; what is to be accomplished and where.

b. Workday duration.

c. Scheduled activities shall indicate continuous flow, from left to right.

5. Identify days per week and shifts per day worked; also, non-work days and holidays.

6. For all schedules submitted, Contractor shall provide the following:

a. Computerized sorts by:

(1) Total Float
(2) Early Start
(3) Area Sort
(4) Trade responsibility

b. 60-day look ahead bar charts by early start.

c. A narrative explaining progress to date on the project, work required in the succeeding update period, a description of the critical path, and comments concerning potential problem areas.

d. Contractor will submit four copies of each of the above.

F. Failure to include any element of work required for performance of this Contract shall not excuse Contractor from completing work required to comply with the Contract Documents, notwithstanding acceptance of Construction Schedule.

G. Submittal of Construction Schedule shall be understood to be Contractor's confirmation that the schedule meets requirements of the Contract Documents, and that work will be executed in sequence indicated in schedule.

1.6 REVIEWS, UPDATES, AND REVISIONS

A. The District will review and return Contractor's Detailed Project Schedule, with summary comments, within Seventeen (17) calendar days. If revisions are required, Contractor shall resubmit Schedule within fourteen (14) calendar days following receipt of the District's comments.

B. After Contractor and the District agree to a final schedule, it will become the Project Construction Schedule and considered part of the Contract Documents. No changes to Schedule will be allowed unless mutually agreed upon with the District.

C. Contractor shall analyze and update the Detailed Project Schedule:

1. As part of monthly payment application, Contractor shall submit to and participate with the District in a schedule review to include:

a. Actual completion dates for work items completed during report period.

b. Actual start dates for work items started during report period.

c. Estimated remaining duration for work items in progress, which will not exceed original duration for activity.

d. Estimated start dates for work items scheduled to start during month following report period, if applicable.

e. Changes in duration of work items.

f. A summary bar chart schedule, organized first by work segment plan, and then by area (building number or other appropriate sub-division) shall show construction progress in each area. The previous schedule shall be included in this report to compute the current performance with the original planned sequence of work.

2. In case of a change to Contractor's planned sequence of work, Contractor shall include a narrative report with updated progress schedule which shall include, but not be limited to, a description of problem areas, current and anticipated delaying factors, and any proposed revisions for a recover plan.

3. All change orders affecting this schedule shall be clearly identified as a separate and new activity.

4. Review of Detailed Project Schedule will not relieve Contractor of responsibility for accomplishing all work in accordance with the Contract Documents.

D. Updates: The Contractor shall submit to the District, with each payment application, an up-to-date Detailed Project Schedule to include following:

1. Work Item Report: Detailing work items and dependencies as indicated on Bar Chart.

2. Separate listing of activities completed during reporting period.

3. Separate listing of activities which are currently in progress, indicating their remaining duration and percentages completed.

4. Separate listing of activities which are causing delay in work progress.

5. Narrative report to define problem areas, anticipated delays, and impact on Detailed Project Schedule. Report corrective action taken, or proposed, and its effect, including effect of changes on schedules of separate contractors.

6. Resolution of conflict between actual work progress and schedule logic: when out-of-sequence activities develop in the Schedule because of actual construction progress, Contractor shall submit a revised schedule to conform to current job sequence and direction.

E. If, according to current updated Detailed Project Schedule, the District determines Contractor is behind the Contract completion date or any interim milestone completion dates, considering all time extensions to which Contractor is entitled, Contractor shall submit a revised schedule, showing a workable plan and a narrative description to complete project on time in accordance with Article 1.06, Paragraph C-2.

1. The District shall withhold progress payments until a revised schedule, acceptable to the District, is submitted by Contractor.

F. Scheduling of change or extra work orders is responsibility of Contractor.

1. Contractor shall revise Detailed Project Schedule to incorporate all activities involved in completing change orders or extra work orders and submit it to the District for review.

G. If the District finds Contractor is entitled to extension of any completion date, under provisions of the Contract, the District's determination of total number of days extension will be based upon current analysis of Construction Schedule, and upon data relevant to extension.

H. Contractor acknowledges and agrees that delays to non-critical activities will not be considered a basis for a time extension unless activities become critical. Non-critical activities are those activities which, when delayed, do not affect an interim or final Contract completion date.

I. Any claim for extension of time shall be made in writing to the Architect not more than seven (7) days after commencement of delay, otherwise, it shall be deemed finally waived for all purposes. Contractor shall provide an estimate of probable effect of such delay on progress of work as part of claim.

1.7 CONTRACTOR'S RESPONSIBILITY

A. Nothing in these requirements shall be deemed to be an assumption of Contractor's authority and responsibility to plan and schedule work as Contractor sees fit, subject to all other requirements of Contract Documents.

B. Contractor shall provide at all times sufficient competent labor, materials, and equipment to properly carry on work and to insure completion of each part in accordance with Construction Schedule and within time agreed.

C. Contractor shall be responsible for ensuring that all submittals to the District are accurate and consistent. Damages, including extra time and cost, caused by inaccuracies from Contractor will be compensated by Contractor.

1.8 SUSPENSION OF PAYMENTS

A. Initial Submittal: The District has the right to withhold progress payments until Detailed Project Schedule is accepted by the District.

B. Update Submittals: The District has the right to withhold progress payments if Contractor fails to update and submit Detailed Project Schedule and reports as required by the District.

1.9 RECORD COPY

A. At completion of work items, submit Detailed Project Schedule reflecting "as-built" sequence.

1.10 FORM OF SUBMITTAL

A. All Detailed Project Schedule submittals shall be transmitted with a Letter of Transmittal and shall include three (3) hard copies and one (1) electronic copy.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:

1. Division 1 Section "Operation and Maintenance Manuals" for submitting operation and maintenance manuals.

2. Division 1 Section "General Commissioning Requirements" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. All submittals to be provided by Contractor within 15 days of award of bid.

B. Architect's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will **not** be provided by Architect for Contractor's use in preparing submittals.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that requires sequential activity.

2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 18 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. DSA Deferred Approval: In addition to the review periods indicated above allow 90 days for DSA review and approval.

E. Identification and Information: Place a permanent label or title block on each paper copy submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information for processing and recording action taken:

    a. Project name.

    b. Date.

    c. Name of Architect.

    d. Name of Construction Manager.

    e. Name of Contractor.

    f. Name of subcontractor.

    g. Name of supplier.

    h. Name of manufacturer.

    i. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).

j. Number and title of appropriate Specification Section.

k. Drawing number and detail references, as appropriate Location(s) where product is to be installed, as appropriate.

l. Other necessary identification.

F. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06 10 00.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

4. Include the following information on an inserted cover sheet:

a. Project name.

b. Date.

c. Name and address of Architect.

d. Name of Construction Manager.

e. Name of Contractor.

f. Name of firm or entity that prepared submittal.

g. Name of subcontractor.

h. Name of supplier.

i. Name of manufacturer.

j. Number and title of appropriate Specification Section.

k. Drawing number and detail references, as appropriate.

l. Location(s) where product is to be installed, as appropriate.

m. Related physical samples submitted directly.

n. Other necessary identification.

G. Options: Identify options requiring selection by the Architect.

H. Deviations: Identify deviations from the Contract Documents on submittals.

I. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

J. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

K. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block and clearly indicate extent of revision.

3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

L. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, and authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

M. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Action Submittals: Submit six paper copies of each submittal, unless otherwise indicated. Architect through owner’s project manager will return at least two copies.

2. Informational Submittals: Submit four paper copies of each submittal, unless otherwise indicated. Architect and owner’s project manager will not return copies.

3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."

4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.

   c. Standard color charts.

   d. Statement of compliance with specified referenced standards.

   e. Testing by recognized testing agency.

   f. Application of testing agency labels and seals.

   g. Notation of coordination requirements.

   h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

   a. Wiring diagrams showing factory-installed wiring.

   b. Printed performance curves.

   c. Operational range diagrams.

   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.

6. Submit Product Data in the following format:
   a. Six paper copies of Product Data, unless otherwise indicated. Architect, through owner’s project manager, will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1067 mm)].

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit four full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Owner’s Project Manager, will return one submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing

color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit four sets of Samples. Architect and Owner will retain two Sample sets; remainder will be returned.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Project Record Documents."

F. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

G. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

P. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

R. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Controls."

S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

U. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

V. Maintenance Data: Comply with requirements specified in Division 1 Section "Operation and Maintenance Manuals."

W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Project Closeout."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION

SECTION 01 41 27
ADDITIONAL CONDITIONS FOR SCHOOL CONSTRUCTION

1.00 GENERAL

1.01 SUMMARY

A. This Section establishes additional requirements not specified in the General Conditions, Supplementary Conditions or elsewhere in the Contract Documents for school projects.

1.02 CHECK LIST

A. All Section numbers referenced refer to Group 1, Chapter 4, Part I, Title 24, California Codes and Regulations.

B. Check list:

[X] Signature of all responsible professionals on record.

[X] Addenda, change orders per Section 4-338.

[X] Inspector approved by DSA. Inspector and continuous inspection of work per Section 4-333(b) and 4-342.

[X] Test and testing laboratory per Section 4-335 (District shall pay the testing laboratory.)

[X] Special inspection per Section 4-333(c).

[X] Contractor shall submit verified reports per Section 4-336 and 4-343(c).

[X] Administration of construction per Part I, Title 24, CCR.

- Duties of Architect, Structural Engineer or Professional Engineer per Section 4-333(a) and 4-341.

- Duties of Contractor per Section 4-343.

- Verified reports per Section 4-336.

[X] Governing Codes: Title 24, CCR.

[X] A copy of Parts I and II of Title 24 shall be kept and available in the field during construction.

[X] DSA shall be notified on start of construction per Section 4-331.

[X] Supervision by the Division of State Architect per Section 4-334.

[X] Show deferred approval items on the first sheet of Specification and Drawings, and give complete design criteria and submittal procedure in appropriate Sections of Specifications.

[X] Additional comments see Specifications.

C. This checklist is for information only.

2.00 PRODUCTS

Not used.

3.00 EXECUTION

Not used.

END OF SECTION

SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

AA	Aluminum Association, Inc. (The)
AAADM	American Association of Automatic Door Manufacturers
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABAA	Air Barrier Association of America
ABMA	American Bearing Manufacturers Association
ACI	American Concrete Institute
ACPA	American Concrete Pipe Association
AEIC	Association of Edison Illuminating Companies, Inc. (The)
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (Now part of CPA)
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction

ALCA	Associated Landscape Contractors of America (Now PLANET - Professional Landcare Network)
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
APA EWS	APA - The Engineered Wood Association; Engineered Wood Systems (See APA - The Engineered Wood Association)
API	American Petroleum Institute
ARI	Air-Conditioning & Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASCE	American Society of Civil Engineers
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International (American Society of Mechanical Engineers International)
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International (American Society for Testing and Materials International)
AWCI	Association of the Wall and Ceiling Industry
AWCMA	American Window Covering Manufacturers Association (Now WCMA)
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association

BIA	Brick Industry Association (The)
BICSI	BICSI, Inc.
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International)
BISSC	Baking Industry Sanitation Standards Committee
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation)
CCC	Carpet Cushion Council
CDA	Copper Development Association
CEA	Canadian Electricity Association
CEA	Consumer Electronics Association
CFFA	Chemical Fabrics & Film Association, Inc.
CGA	Compressed Gas Association
CIMA	Cellulose Insulation Manufacturers Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CRRC	Cool Roof Rating Council
CPA	Composite Panel Association
CPPA	Corrugated Polyethylene Pipe Association
CRI	Carpet and Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CSA	CSA International (Formerly: IAS - International Approval Services)
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CSSB	Cedar Shake & Shingle Bureau
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute)

DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association (Electrostatic Discharge Association)
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA)
FIBA	Federation Internationale de Basketball (The International Basketball Federation)
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation)
FM Approvals	FM Approvals LLC
FM Global	FM Global (Formerly: FMG - FM Global)
FMRC	Factory Mutual Research (Now FM Global)
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.
FSA	Fluid Sealing Association
FSC	Forest Stewardship Council
GA	Gypsum Association
GANA	Glass Association of North America
GRI	(Part of GSI)
GS	Green Seal
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)
HPVA	Hardwood Plywood & Veneer Association
HPW	H. P. White Laboratory, Inc.

IAS	International Approval Services (Now CSA International)
IBF	International Badminton Federation (Now BWF)
ICEA	Insulated Cable Engineers Association, Inc.
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology
IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
ISO	International Organization for Standardization Available from ANSI
ISSFA	International Solid Surface Fabricators Association
ITS	Intertek Testing Service NA (Now ETL SEMCO)
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LMA	Laminating Materials Association (Now part of CPA)
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MH	Material Handling (Now MHIA)
MHIA	Material Handling Industry of America
MIA	Marble Institute of America
MPI	Master Painters Institute

MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International (National Association of Corrosion Engineers International)
NADCA	National Air Duct Cleaners Association
NAGWS	National Association for Girls and Women in Sport
NAIMA	North American Insulation Manufacturers Association
NBGQA	National Building Granite Quarries Association, Inc.
NCAA	National Collegiate Athletic Association (The)
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NETA	InterNational Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	NFPA (National Fire Protection Association)
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association)
NOMMA	National Ornamental & Miscellaneous Metals Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association

NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)
NWWDA	National Wood Window and Door Association (Now WDMA)
OPL	Omega Point Laboratories, Inc. (Now ITS)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PLANET	Professional Landcare Network (Formerly: ACLA - Associated Landscape Contractors of America)
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
RIS	Redwood Inspection Service
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)
SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association (Now IGMA)
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association

SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SMPTE	Society of Motion Picture and Television Engineers
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division)
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWI	Steel Window Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc. (Now TCNA)
TCNA	Tile Council of North America, Inc.
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TMS	The Masonry Society
TPI	Truss Plate Institute, Inc.
TPI	Turfgrass Producers International
TRI	Tile Roofing Institute
UL	Underwriters Laboratories Inc.
UNI	Uni-Bell PVC Pipe Association
USAV	USA Volleyball
USGBC	U.S. Green Building Council
USITT	United States Institute for Theatre Technology, Inc.
WASTEC	Waste Equipment Technology Association
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCSC	Window Covering Safety Council

(Formerly: WCMA - Window Covering Manufacturers Association)

WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association)
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California)
WIC	Woodwork Institute of California (Now WI)
WMMPA	Wood Moulding & Millwork Producers Association
WSRCA	Western States Roofing Contractors Association
WWPA	Western Wood Products Association

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

IAPMO	International Association of Plumbing and Mechanical Officials
ICC	International Code Council
ICC-ES	ICC Evaluation Service, Inc.
UBC	Uniform Building Code (See ICC)

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSA	General Services Administration
HUD	Department of Housing and Urban Development
LBL	Lawrence Berkeley National Laboratory

NCHRP National Cooperative Highway Research Program
(See TRB)

NIST National Institute of Standards and Technology

OSHA Occupational Safety & Health Administration

PBS Public Buildings Service
(See GSA)

PHS Office of Public Health and Science

RUS Rural Utilities Service
(See USDA)

SD State Department

TRB Transportation Research Board

USDA Department of Agriculture

USPS Postal Service

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG Americans with Disabilities Act (ADA)
Architectural Barriers Act (ABA)
Accessibility Guidelines for Buildings and Facilities
Available from U.S. Access Board

CFR Code of Federal Regulations
Available from Government Printing Office

DOD Department of Defense Military Specifications and Standards
Available from Department of Defense Single Stock Point

DSCC Defense Supply Center Columbus
(See FS)

FED-STD Federal Standard
(See FS)

FS Federal Specification
Available from Department of Defense Single Stock Point

Available from Defense Standardization Program

Available from General Services Administration

Available from National Institute of Building Sciences

FTMS Federal Test Method Standard
(See FS)

MIL (See MILSPEC)

MIL-STD (See MILSPEC)

MILSPEC Military Specification and Standards
Available from Department of Defense Single Stock Point

UFAS Uniform Federal Accessibility Standards
Available from Access Board

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation

CCR California Code of Regulations

CPUC California Public Utilities Commission

TFS Texas Forest Service
Forest Resource Development

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 43 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.

2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:

1. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of **five** previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.

2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.

2. Project title and number.

3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.

6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.

8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.

11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name and signature of laboratory inspector.

13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.

2. Statement on condition of substrates and their acceptability for installation of product.

3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

4. Results of operational and other tests and a statement of whether observed performance complies with requirements.

5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to **ASTM E 329**; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.

b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect **seven** days in advance of dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow **seven** days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.

2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor**, and the Contract Sum will be adjusted by Change Order**.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least **48** hours in advance of time when Work that requires testing or inspecting will be performed.

3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.

4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.

4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.

5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.

2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

4. Facilities for storage and field curing of test samples.

5. Delivery of samples to testing agencies.

6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: **Owner will engage** a qualified **testing agency** and/or **special inspector** to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner**, as indicated in Statement of Special Inspections attached to this Section**, and as follows:

B. Special Tests and Inspections: Conducted by a qualified **testing agency** or **special inspector** as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.

2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.

5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - *EXECUTIO*N

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible

as possible. Comply with the Contract Document requirements for cutting and patching in Division 1 Section "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 45 22
AUTHORITY AND DUTIES OF INSPECTOR

1.00 GENERAL

1.01 Responsibilities: Inspector will inspect all work done and materials furnished. Such inspection may extend to all or any part of the work, and to the preparation, fabrication, or manufacture of the materials to be used. The inspector will not alter or waive the provisions of these Specifications.

1.02 Authority: The inspector will inform the Owner as to the progress of the work and the manner in which it is being done; also, the inspector will call the Contractor's attention to the items observed to be in non-conformance with the Plans and Specifications. The inspector will not approve or accept portions of the work, issue instructions contrary to the Plans and Specifications, or act as foreman for the Contractor. The inspector will reject defective material and object to work observed to be improperly performed, subject to final decision by the Owner. The inspector will exercise additional authority only as authorized by the Owner.

2.00 MATERIALS

Not Used

3.00 EXECUTION

Not Used

4.00 MEASUREMENT AND PAYMENT

4.01 Full compensation for conforming to the provisions of this article shall be included in the contract items for which the work relates with no additional compensation allowed therefor.

END OF SECTION

SECTION 01 45 29
TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cooperate with the Owner's selected testing agency, the Project Inspector, and others responsible for testing and inspecting the Work, and assist the Owner by coordinating such testing and inspecting services as specified in this Section and/or elsewhere in the Contract Documents including the attached Division of State Architect Structural Tests and Inspections sheet (enclosed).

B. Related Work Specified Elsewhere:

1. Requirements for testing may be required in other Sections of these Specifications.

2. Where no testing requirements are specified or required by reference standards or authorities having jurisdiction, the Owner may require such testing to be performed under current pertinent standards for testing. Payment for such testing will be made as described herein.

C. Work Not Included:

1. The Owner will select a pre-qualified independent testing laboratory and Inspector as approved by the Division of the State Architect, Office of Regulation Services.

2. The Owner will pay for initial services of the testing laboratory as further described hereinafter.

1.2 QUALITY ASSURANCE

A. The Owner will select an independent testing laboratory to conduct the tests. Selection of the material required to be tested shall be by the laboratory or the Owner's representative and not by the Contractor.

B. Qualifications of Testing Laboratory: The testing laboratory shall be qualified to the Owner's acceptance in accordance with ASTM E 329. The testing laboratory shall be qualified by the Division of State Architect in accordance with Interpretation of Regulation No. 1R1-1.

C. Codes and Standards: Testing, when required, will be in accordance with pertinent codes and regulations and with selected standards of the American Society for Testing and Materials and other organizations or agencies which publish recognized codes, standards, or tests. Refer to Article 3.04 – Required Testing of this Section.

D. The project specifications shall be in accordance with the provisions of the Standard Specifications for Public Works Construction (SSPWC) 2012 Edition.

1.3 TEST REPORT DISTRIBUTION

A. Promptly process and distribute required copies of test reports and related instructions to ensure necessary retesting and/or replacement of materials with the least possible delay in progress of the Work.

B. One copy of test reports shall be forwarded to the Division of the State Architect by the testing agency. Such reports shall include tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Samples taken but not tested shall also be reported. Records of special sampling operations as required shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of Title 24 and with the approved specifications. Test reports shall show the specified design strength. They shall also state definitely whether or not the material or materials tested comply with requirements.

C. Each testing agency shall submit to the Division of the State Architect a verified report in duplicate covering tests which are required to be made by that agency during the progress of the project. Such report shall be furnished each time that work on the project is suspended, including tests up to that time, and at the completion of the project.

1.4 PAYMENT FOR TESTING SERVICES

A. Initial Services: The Owner will pay for initial testing and inspection except as specifically modified herein-after or as specified otherwise in technical sections. Provided the results of inspection indicating compliance with the Contract Documents.

B. Retesting: When initial tests or inspection indicate noncompliance with the Contract Documents, subsequent retesting or re-inspection occasioned by the noncompliance shall be performed by the same testing laboratory or Inspector and the costs thereof will be deducted by the Owner from the Contract Sum. Retesting and re-inspection will continue until test or inspection results indicate compliance.

C. Code Compliance Testing: Inspections and tests required by codes or ordinances, or by authorities having jurisdiction and made by a legally constituted authority, shall be the responsibility of and shall be paid for by the Owner, but back charged to the Contractor in case of retesting due to noncompliance.

D. Specified Inspections and Tests: Tests and inspections specified in the Specifications, directly or by reference, shall be coordinated by the Contractor at his expense and paid for by the Owner. Corrections of noncompliance and test failures shall be paid for by the Owner, but shall be back charged to the Contractor. Re-inspection and retesting shall be in accordance with paragraph 1.04-B.

E. Contractor’s Convenience Testing: Inspecting or testing performed exclusively for the Contractor’s convenience shall be the sole responsibility of and at the expense of the Contractor.

1.5 INSPECTION BY THE OWNER

A. The Owner and his representatives will have access, for the purpose of inspection, to parts of the work and to the shops wherein the work is in preparation, and the Contractor shall maintain proper facilities and provide safe access for such inspection.

B. The Owner shall have the right to reject materials and workmanship which are defective, and to require their correction. Rejected workmanship shall be satisfactorily corrected and rejected materials shall be removed from the premises without charge to the Owner. If the Contractor does not correct such rejected within a reasonable time, fixed by written notice, the Owner may correct rejected work and charge the expense to the Contractor.

C. Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire work to make an examination of work already completed by removing or tearing out the same, the Contractor shall on request promptly furnish necessary facilities, labor and materials. If such work is found to be defective in respect due to fault of the Contractor or his subcontractor, he shall defray expenses of such examinations and of satisfactory reconstruction. If, however, such work is found to meet

the requirements of the contract, the additional cost of labor and material necessarily involved in the examination and replacement will be allowed the Contractor.

1.6 PROJECT INSPECTOR

A. An Inspector employed by the Owner in accordance with the requirements of State of California Building Code, Title 24, Part 1, and qualified in accordance with Division of State Architect will be assigned to the work. His duties are specifically defined in Title 24, Part 1, Section 4-342, reprinted herein:

1. Duties of the Project Inspector.

(A) General: The Project Inspector shall act under the direction of the A/E/Engineer.

(B) Duties: The general duties of the Project Inspector in fulfilling his or her responsibilities are as follows:

(1) Inspection: He or she must have actual personal knowledge, obtained by his personal inspection of the work of construction in stages of its progress, that the requirements of the approved plans and specifications are being completely executed. Inspection means complete inspection of every part of the work. Work, such as concrete work or brick work which can be inspected only as it is placed, shall require the constant presence of the Project Inspector. Other types of work which can be completely inspected after the work is installed may be carried on while the Inspector is not present. In any case, the Project Inspector must personally inspect every part of the work. In no case shall the Project Inspector have or assume duties which will prevent him or her from providing inspection.

The Project Inspector may obtain personal knowledge of the work of construction, either on-site or off-site, performed under the inspection of a Special Inspector or Assistant Inspector from the reporting of others on testing or inspection of materials and workmanship for compliance with the plans, specifications and applicable standards. The exercise of reasonable diligence to obtain the facts shall be required.

(2) Relations with A/E/Engineer: The Project Inspector shall work under the general direction of the A/E/Engineer. Inconsistencies or seeming errors in the A/E/Engineer for his interpretation and instructions. In no case, however, shall the instruction of the A/E/Engineer be construed to cause work to be done which is not in conformity with the approved plans, specifications, and change orders.

(3) Job File: The Project Inspector shall keep a file of approved plans and specifications (including approved addenda or change orders) on the job, and shall immediately return unapproved documents to the A/E for proper action. The Project Inspector, as a condition of his employment, shall have and maintain on the job, codes and documents referred to in the plans and specifications.

(4) Project Inspector’s Semi-Monthly Reports: The Project Inspector shall keep the A/E/Engineer thoroughly informed as to the progress of the work by making semi-monthly reports in writing as required in Section 37.

(5) Not Used.

(6) Construction Procedure Records: The Project Inspector shall keep a record of certain phases of construction procedure. All such records of construction procedure shall be kept on the job until the completion of the work. These records shall be made a part of the permanent school records.

(7) Deviations: The Project Inspector shall notify the Contractor, in writing, of deviations from the approved plans and specifications which are not immediately corrected by the Contractor when brought to his or her attention. Copies of such notice shall be forwarded immediately to the A/E/Engineer.Failure on the part of the Project Inspector to notify the Contractor of deviations from the approved plans and specifications shall in no way relieve the Contractor of responsibility to complete the work covered by his or her contract in accordance with the approved plans and specifications and laws and regulations.

(8) Verified Reports: The Project and Special Inspectors shall each make and submit to the Division of the State Architect verified reports. The Project Inspector shall prepare and deliver to the Division of the State Architect detailed statements of fact regarding materials, operations, etc., when requested. Violations: Failure, refusal, or neglect on the part of the Inspector to notify the Contractor of work which does not comply with the requirements of the approved plans and specifications, or failure, refusal, or neglect to report immediately, in writing, such violation to the A/E/Engineer, to the School Board, and to the Division of the State Architect shall constitute a violation of the act and shall be cause for the Division of the State Architect to take action.

Note: Authority cited: Section 39152 and 81142, Education Code. Reference: Sections 39151, 39153, 81141 and 81143, Education Code."

B. The work of construction in stages of progress shall be subject to the personal continuous observation of the Project Inspector as continuous observation is defined by Title 24. He shall have free access to all parts of the work at any time. The Contractor shall furnish the Project Inspector reasonable facilities for obtaining such information as may be necessary to keep him fully informed respecting the progress and manner of the work and the character of the materials. Inspection of the work shall not relieve the Contractor from obligation to fulfill this Contract.

1.7 OWNER'S OTHER PERSONNEL

A. From time to time, other personnel in the employ of the Owner may inspect the Work when the Work is in progress but shall have no authority to direct the Contractor or request changes in the Work except as may be provided elsewhere in the Contract Documents.

1.8 REPRESENTATIVE OF THE DIVISION OF THE STATE ARCHITECT

A. Architect shall have access to the site in accordance with Title 24, Part 1, 4-333.

B. Field Engineers and Inspectors from D.S.A. Structural Safety Section, Fire & Life Safety Review and Access Compliance shall have access to the site in accordance with Title 24, Part 1, 4-334.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 COOPERATION WITH TESTING LABORATORY AND INSPECTORS

A. Inspectors and representatives of the testing laboratory shall have access to the work. Provide facilities for such access in order that the testing, inspection, and the obtaining of samples may be done properly.

B. Contractor shall deliver material specimens to the Owner's testing lab, which must by terms of the Contract be tested prior to inclusion in the Project, at least 45 days prior to scheduled delivery to the job site.

C. Material shipped by the Contractor from the source of supply prior to having satisfactorily passed such testing and inspection or prior to the receipt of notice from said representative that such testing and inspection will not be required shall not be incorporated in the job.

3.2 TAKING SPECIMENS

A. Field specimens and samples for testing, unless otherwise provided in these Contract Documents, shall be selected and taken by the Testing Laboratory or Project Inspector and not the Contractor. Sampling equipment and personnel will be provided by the testing laboratory. Deliveries of specimens and samples to the testing laboratory will be performed by the testing laboratory. Soil samples for approval of import fill shall be picked-up by the Testing Laboratory.

3.3 SCHEDULES FOR TESTING

A. Establishing Schedule:

1. By advance discussion with the testing laboratory selected by the Owner, determine the time required for the laboratory to perform its tests and to issue each of its findings.

2. Provide required time within the construction schedule.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate such changes of schedule with the testing laboratory as required.

C. Adherence to Schedule: When the testing laboratory is ready to test according to the determined schedules, but is prevented from testing or taking specimens due to incompleteness of the work, extra charges for testing attributable to the delay may be back-charged to the Contractor and will be deducted by the Owner from the Contract Sum.

3.4 REQUIRED TESTING

Tests and inspections for the following items, where applicable, will be required in accordance with referenced Sections/Chapters of California Building Code, 2016 Edition, Title 24, Part 2 and DSA approved form 103 T&I:

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Section:

1. Division 1 Section "Summary" for limitations on work restrictions and utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized steel bases for supporting posts.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: ~~Required.~~

B. Common-Use Field Office: ~~Required.~~

C. ~~Inspector Office: Contractor to provide 20' 0" X 8' 0" prefabricated or mobile unit with serviceable finishes, temperature controls, power, data, phone service and foundations adequate for normal loading. Office to be used exclusively by Inspector of Record during construction. Access to trailer shall be through gate in temporary fencing.~~ Not required

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Division 1 Section "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities. Contractor not to use adjacent school toilet facilities.

E. Heating and/or Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service overhead or underground, unless otherwise indicated.

2. Connect temporary service to Owner's existing power source, as directed by Owner.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.

b. Ambulance service.

c. Contractor's home office.

d. Architect's office.

e. Engineers' offices.

f. Owner's office.

g. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.

2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Division 2 Section "Earthwork."
3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.

4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Division 2 Section "Asphalt Paving."

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.

2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Street parking is available as posted.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Elevator Use: Use of elevators is not permitted.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Comply with requirements of the latest SWRCB Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Division 2 Section "Site Clearing."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of the latest SWRCB Construction General Permit or authorities having jurisdiction, whichever is more stringent.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Division 2 Section "Tree Protection and Trimming."

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.

   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather tight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.

2. Keep interior spaces reasonably clean and protected from water damage.

3. Discard or replace water-damaged and wet material.

4. Discard, replace or clean stored or installed material that begins to grow mold.

5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.

2. Remove materials that can not be completely restored to their manufactured moisture level within **48** hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION

SECTION 01 60 20
STORAGE AND PROTECTION

PART 1 – GENERAL

1.1 SUMMARY

A. Protect products scheduled for use in the Work by means including, but not necessarily limited to, those described in this Section.

B. Related work:

1. Documents affecting work of this Section include, but are not necessarily limited to the General Conditions and Supplementary Conditions.

2. Additional procedures also may be prescribed in other Sections of these Specifications.

1.2 QUALITY ASSURANCE

A. Include within the Contractor's quality assurance program such procedures as are required to assure full protection of work and materials.

1.3 MANUFACTURERS' RECOMMENDATIONS

A. Except as otherwise approved by the District, determines and comply with manufacturers' recommendations on product handling, storage, and protection.

1.4 PACKAGING

A. Deliver products to the job site in their manufacturer's original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the Owner.

B. The District may reject as non-complying such material and products that do not bear identification satisfactory to the District as to manufacturer, grade, quality, and other pertinent information.

1.5 PROTECTION

A. Protect finished surfaces, including jambs and soffits of openings used as passageways, through which equipment and materials are handled.

B. Provide protection for finished surfaces in traffic areas prior to allowing equipment or materials to be moved over such surfaces.

C. Maintain finished surfaces clean, unmarred, and suitably protected until accepted by the Owner.

1.6 REPAIRS AND REPLACEMENTS

A. In event of damage, promptly make replacements and repairs to the approval of the Architect and at no additional cost to the Owner.

B. Additional time required to secure replacements and to make repairs will not be considered by the District to justify an extension in the Contract Time of Completion.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. Closeout Procedures

B. Final Cleaning.

C. Pest Control.

D. Adjusting.

E. Demonstration and Instructions.

F. Project Record Documents.

G. Operation and Maintenance Data.

H. Warranties.

I. Spare Parts and Maintenance Materials.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect's review.

B. Prepare and submit to Architect a list of items to be completed or corrected, the value of the items on the list, and reasons why the Work is not complete.

C. Submit written request to Architect for review of Work.

D. Submit warranties, bonds, service agreements, certifications, record documents, maintenance manuals, receipt of spare parts and similar closeout documents.

E. Make final changeover of permanent locks and deliver keys to Owner.

F. Terminate and remove temporary facilities from Project site.

G. Advise Owner of change over in heat and other utilities.

H. Provide submittals to Architect that are required by governing or other authorities.

I. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

J. Submit affidavit of payment of debts and claims, AIA Document G706.

K. Submit affidavit of release of liens, AIA Document G706A.

L. Submit consent of contractors surety to final payment, AIA Document G707.

M. Owner will occupy all portions of the building as specified in Section 01110.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final review by Architect.

B. Employ experienced professional cleaners for final cleaning.

C. Clean interior and exterior glass and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

D. Vacuum carpeted and soft surfaces. Shampoo if visible stains exist.

E. Clean equipment and plumbing fixtures to a sanitary condition.

F. Clean exposed surfaces of grilles, registers and diffusers.

G. Replace filters of operating mechanical equipment.

H. Clean debris from roofs, gutters, downspouts, and drainage systems.

I. Clean site; sweep paved areas, rake clean landscaped surfaces.

J. Remove waste and surplus materials, rubbish, and construction facilities from the site.

K. Clean light fixtures and replace burned out lamps and bulbs.

L. Relamp all lamps and bulbs in lighting fixtures.

M. Replace defective and noisy ballasts and starters in fluorescent fixtures.

N. Leave project clean and ready for occupancy by Owner.

1.4 PEST CONTROL

A. Engage an experienced, licensed exterminator to make final inspection and rid Project of rodents, insects, and other pests. Submit final report to Architect.

1.5 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.6 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products, systems, and equipment to Owner's personnel two weeks prior to date of final review.

B. For each demonstration submit list of participants in attendance.

C. Provide two copies of video tape of each demonstration and instructions session.

D. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at equipment location.

G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site, one set of the following record documents; record actual revisions to the Work in contrasting color.

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.

B. Store Record Documents separate from documents used for construction.

C. Record information concurrent with construction progress.

D. Specifications: Legibly mark and record at each Product Section in contrasting color ink, description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.

2. Supplier and installers name and contact information.

3. Changes made by Addenda and Modifications.

E. Contract Drawings and Shop Drawings: Legibly mark each item in contrasting color ink to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.

3. Field changes of dimension and detail.

4. Details not on original Contract Drawings.

5. Revisions to electrical circuitry and locations of electrical devices and equipment.

6. Note change orders, alternate numbers, and similar information, where applicable.

7. Identify each record drawing with the written designation of □RECORD DRAWING□ located in prominent location.

F. Record Digital Data Files: Immediately before inspection for Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.

2. Format: Annotated PDF electronic file with comment function enabled.

3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

4. Refer instances of uncertainty to Architect for resolution.

5. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

(a) Refer to Section 01 33 00 □Submittal Procedures□ for requirements related to use of Architect's digital data files.

(b) Architect will provide data file layer information, record markups in separate layers.

G. Final Property Survey: Under the provisions of Section 01 78 00.

H. Record Construction Schedule: Under the provisions of Section 01 32 17.

I. Submit documents to Architect at time of Substantial Completion.

1.8 OPERATION AND MAINTENANCE DATA

A. Summary:

1. Organize operation and maintenance data with directory.

2. Provide operation and maintenance manuals for products, systems, subsystems, and equipment.

3. Refer to Divisions 2 thru 16 for specific operation and maintenance manual requirements for the Work in those Divisions.

B. Submit two sets prior to final review, bound in 8-1/2 inch x 11 inch, three ring D size binders with durable vinyl covers.

C. Prepare binder covers with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

D. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with laminated plastic tabs.

E. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Engineers, Contractor, subcontractors, and major equipment suppliers and manufacturers.

F. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:

1. Performance and design criteria.

2. List of equipment.

3. Parts list for each component.

4. Start-up procedures.

5. Shutdown instructions.

6. Normal operating instructions.

7. Wiring diagrams.

8. Control diagrams.

9. Maintenance instructions for equipment and systems.

10. Maintenance instructions for finishes, including recommended cleaning methods and materials.

G. Part 3: Project documents and certificates, including the following:

1. Shop drawings and product data.

2. Air and water balance reports.

3. Certificates.

4. Warranties.

1.9 WARRANTIES

A. Commencement of warranties shall be date of Substantial Completion.

B. For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

C. Provide duplicate notarized copies in operation and maintenance manuals.

D. Execute and assemble documents from subcontractors, suppliers, and manufacturers.

E. Provide Table of Contents and assemble in binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on the work that incorporates the products.

H. Manufacturer's disclaimer and limitations on product warranties do not relieve suppliers, manufacturer's, and subcontractors required to countersign special warranties with Contractor.

I. When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

J. When work covered by warranty has failed and has been corrected, reinstate warranty by written endorsement. Reinstated warranty shall be equal to original warranty with equitable adjustment for depreciation.

K. Upon determination that Work covered by warranty has failed, replace or repair Work to an acceptable condition complying with requirements of the Contract Documents.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project site and place in location as directed.

C. Obtain signed receipt for delivery of materials and submit prior to request for final review by Architect.

END OF SECTION

SECTION 01 77 01
PROJECT CLOSEOUT

PART 1 – GENERAL

1.1 REFERENCE

A. Requirements in Addenda, Alternates, Conditions, and Division 1 collectively apply to this work.

1.2 GENERAL

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

B. Comply with requirements stated in “Conditions Of The Contract” and in “Specifications” for administrative procedures in closing out the Work.

C. Related Work Specified Elsewhere:

1. Guarantee Form: See General Conditions.
2. Close-out Submittals: See Respective Spec. Sections.

1.3 PREFINAL INSPECTION; SUBSTANTIAL COMPLETION

A. Pre-final Inspection:

1. Upon "substantial completion" of the Work, Contractor shall notify Architect and request a "pre-final inspection" of the Work.

2. If Architect concurs that "substantial completion" has been reached, he will review the Work and list items to be completed or corrected. List will be amended as required to include items subsequently observed.

B. Substantial Completion Defined: "Substantial Completion" of the Work is the status, as approved by the Architect, when construction is sufficiently complete, in accordance with the Contract Documents, so District can occupy or utilize the Work for the use for which it is intended, without incomplete work scope items either interior or exterior.

1.4 FINAL INSPECTION

A. Reference: See General and Supplementary Conditions, titled "Final Adjustment And Completion".

B. Final Inspection: When Contractor has complied with above Article, Architect will review the Work and list any items to be completed or corrected.

C. Contractor shall correct and/or complete the Work.

1.5 GUARANTEES

A. General: Contractor shall guarantee in writing to District that:
1. "Contractor will repair or replace any and all work, together with any other work which may be displaced, damaged or marred in so doing, that may prove defective in workmanship and/or materials, or fail to conform to contract provisions and requirements within the period cited below, such period to begin on date of

acceptance of work by District, without any expense whatsoever to District, ordinary wear and tear, and unusual abuse or neglect excepted."

2. Format: Contractor shall submit guarantees typed in the format indicated in "Guarantee Form", See General Conditions Exhibit K.

3. Number of Copies: Submit in duplicate to Architect.

4. Required Guarantees:

5. General: Submit all guarantees listed herein or required by various Spec. Sections; more stringent shall apply. Guarantee periods begin at the date of acceptance written on the “Notice Of Completion” as accepted by the School District Board of Education.

6. General Guarantee:

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

1.6 WARRANTIES

A. General: Submit all warranties required by various Spec. Sections.

1.7 CERTIFICATES

A. General: Submit all certificates and Verified Reports required by various Spec. Sections or listed herein, notarized as required.

1.8 OPERATION & MAINTENANCE DATA

A. General: Submit all manuals required by various General Conditions, Spec. Sections or listed herein; two copies each.

1.9 PROJECT RECORD DOCUMENTS

A. See Section 01 77 20.

B. Additional Information Required: In addition to the requirements in Section 01720, provide the following:

1. By measured dimensions (vertical and horizontal) from permanent improvements or buildings, locate the following new underground utilities, piping systems, and their appurtenances; and existing systems when known, uncovered, in work areas, adjacent to work areas, or modified as part of the work of this Project:

   a. Site drainage systems piping and cleanouts.

   b. Landscape sprinkler systems: Complete system, except non-pressure branch lines from automatic control valves to heads.

   c. All fire protection systems.

d. All plumbing systems.

e. All electrical systems.

f. All pool systems.

2. For gravity flow lines such as sewers and storm drains, locate all cleanouts, and indicate invert elevations at building lines, changes in direction, intersections, and property lines.

3. Electrical Underground: In addition to locations, state number and sizes of conduits and wires, and provide invert elevations.

4. Work Concealed Within Building Construction: Indicate by dimension the locations of Plumbing Systems, HVAC Systems, and Fire Protection Systems.

5. Show any work performed that deviates from original Contract Documents.

6. Show all work authorized by Change Order(s) and number of that Change Order.

END OF SECTION

SECTION 01 77 20
PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.1 SUMMARY

A. Throughout progress of the Work of this Contract, maintain an accurate record of all changes in the Contract Documents, as described in 3.1 below.

B. Contractor shall periodically transfer the recorded changes to a set of "as-built" documents, as described in Article 3.02 below, and submit such "as-builts" to Architect for Architect's use as required.

C. The Project Manager shall verify that as-builts are current, on a monthly basis, prior to the processing of pay requests. Pay Requests WILL NOT be processed unless the As-Builts have been verified.

D. Related work described elsewhere: Section 01 33 00 "Submittal Procedures".

1.2 QUALITY ASSURANCE

A. General: Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved in advance by the Architect.

B. Accuracy of records: Thoroughly coordinate all changes within the Record Documents, making adequate and proper entries on each page of a clean set of Specifications and each sheet of Drawings and other Documents where such entry is required to properly show the change. Accuracy of records shall be such that future search for items shown in the Contract Document may reasonably rely on information obtained from the approved Record Documents.

C. Timing of entries: make all entries within 24 hours after receipt of information.

1.3 SUBMITTALS

A. General: The Architect's approval of the current status of Record Documents will be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.

B. Progress submittals: Prior to submitting each request for progress payment, secure the Architect's approval of the Record Documents as currently maintained.

C. Final submittals: Prior to submitting request for final payment, submit the Final Record Documents to the Architect and secure his approval.

1.4 PRODUCT HANDLING

A. Use all means necessary to maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of the recorded data to the Final Record Documents. In the event of loss of recorded data, use all means necessary to secure the data to the Architect's approval; such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials and, in such case, all replacements shall be to the standards originally specified in the record Documents.

PART 2 – PRODUCTS

2.1 RECORD DOCUMENTS

A. Promptly following award of Contract, mark one set of documents (bluelines) as "RECORD DOCUMENTS-JOB SET". All Addenda, issued during the Bid, shall be "cut and pasted" onto the appropriate sheets or pages of the Plans and Specifications.

1. In addition to the requirements set forth, directing the Contractor to transfer all the information above to a reproducible set of prints and CAD disk, the Contractor shall provide the actual JOB SET ("marked-up prints") referenced above to the District at the completion of construction, which will remain the District's property.

PART 3 – EXECUTION

3.1 MAINTENANCE OF JOB SET

A. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed devise a suitable method for protecting the "RECORD DOCUMENTS-JOB SET" to the approval of the Architect.

2. Do not use the Job Set for any purpose except entry of new data and for review by the Architect, until start of transfer of data to Final Record Documents.
3. Maintain the Job Set at the site of work where designated by the Architect.

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

C. Making entries on other documents:

1. Where changes are caused by directives issued by the Architect, clearly indicate the change by note in ink, colored pencil, or rubber stamp.
2. Where changes are caused by Contractor-originated proposals approved by the Architect, including inadvertent errors by the Contractor that have been accepted by the Architect, clearly indicate the change by note in erasable colored pencil.
3. Make entries in the pertinent documents as approved by the Architect.

D. Conversion of schematic layouts:

1. In most cases on the Drawings, arrangement of conduits and circuits, piping, ducts, and other similar items is shown schematically and is not intended to portray precise physical layout. Final physical arrangement is as determined by the Contractor subject to the Architect's approval. However, design of future modifications of the facility may require accurate information as to the final physical arrangement of items that are shown only schematically on the Drawings.
2. Show on the job set of Record Drawings, by dimension accurate to within 1", the centerline of each run of items such as are described in Paragraph 3.1 D.1 above. Clearly identify the item by accurate note such as "CAST-IRON DRAIN," "GALV. WATER" etc. Show by symbol or note the vertical location of the item ("under slab," "in ceiling plenum" "exposed," etc.). Make all identification sufficiently descriptive that it may be related reliably to the Specifications.

3. The Architect may waive the requirements for conversion of schematic data where, in the Architect's judgment, such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.
4. Timing of entries: Be alert to changes in the work from how it is shown in the Contract Documents. Promptly, and in no case later than 24 hours after the change has occurred and been made known to the Contractor, make the entry or entries required.

E. Accuracy of entries: Use all means necessary, including the proper tools for measurement, to determine actual locations of the installed items.

3.2 FINAL RECORD DOCUMENTS

A. General: The purpose of the Final Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Approval of recorded data prior to transfer: Using the CAD disk and sepia vellums described in Section 01030, and prior to start of transfer of recorded data thereto, secure a review by the Architect and Project Manager of all recorded data. Make all required revisions.

C. Transfer of data to drawings: Carefully transfer all change data shown on the job set of Record Drawings to the CAD disk and corresponding sepias, coordinating the changes as required, and clearly indicating at each affected detail and other drawing the full description of all changes made during construction and the actual location of items described in Paragraph 3.1 E. above. Call attention to each entry by drawing a “cloud” around the area or areas affected. Make all change entries on the sepias neatly, consistently, and in ink or crisp black pencil.

D. Transfer of data to other Documents: If the documents other than Drawings have been kept clean successfully during progress of the work, and if entries have been sufficiently orderly thereon to the approval of the Architect, the job set of those Documents (other than Drawings) will be accepted by the Architect as Final Record Documents for those documents. If any such document is not so approved by the Architect, secure a new copy of that document from the Architect at the Architect’s usual charge for reproduction; carefully transfer the change data to the new copy and to the approval of the Architect.

E. Review and approval: Submit the completed total set of Record Documents to the Architect as described in Paragraphs 1.3 C. and 2.1 A , above. Participate in review meeting or meetings as required by the Architect, make all required changes in the Record Documents, sign and date Record Documents, and promptly deliver the Final Record Documents to the Architect.

3.3 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor shall have no responsibility for recording changes in the work subsequent to acceptance of the work by the District, except for changes resulting from replacements, repairs, and alterations made by the Contractor as part of his guarantee.

END OF SECTION

SECTION 01 77 40
WARRANTIES

PART 1 – GENERAL

1.1 SUBMITTAL REQUIREMENTS

A. Assemble Warranties and Service and Maintenance Contracts, executed by each of the respective Manufacturers, Suppliers, and Subcontractors.

B. Number of original signed copies required: Four (4) each.

C. Table of Contents: Neatly typed in orderly sequence.

D. Provide complete information for each one of the following items:
1. Product or Work Item.
2. Firm with name of principal, address, and telephone number.
3. Beginning date of Warranty or Service and Maintenance Contract.
4. Duration of Warranty or Service and Maintenance Contract.
5. Provide the following information for the District's Personnel:
   a. Procedures in case of failure of malfunction.
   b. Instances which affect Warranty.
6. Contractor, name of responsible principal, address, and telephone number.

1.2 SUBMITTAL FORM

A. The list identifies the submittal form requirements for WARRANTIES:
1. Punch sheets for standard 3-ring binder.
2. Size: 8-1/2 x 11 inches.
3. Fold larger sheets to fit into binder.
4. Cover: Identify each packet with typed or printed title "WARRANTIES". List:
   a. Title of Project.
   b. Name of Contractor.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE MANUALS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Compilation of product data and related information appropriate for the District's maintenance and operation of products and equipment furnished under the Contract.

2. Instruction of the District's personnel in the maintenance of products and in the operation of equipment and systems.

B. Contractor shall comply with the requirements of this Specification Section, except where individual Specification Sections requirements are more stringent.

1.2 SUBMITTAL PROCEDURES

A. Preliminary: Submit one copy of proposed manuals to the Project Manager at least fifteen (15) days prior to final inspection or acceptance.

B. Final: Following the indoctrination and instruction of the District's operating and maintenance personnel, review proposed revisions to the manual with the Project Manager.

1. Submit three copies of accepted data in final form 10 days after final inspection. Approval of submittal is a pre-requisite at Substantial Completion prior to the District's agendizing project for acceptance by the Governing Board.

PART 2 – PRODUCTS

2.1 FORMAT

A. Size: minimum 4 inch three-ring binders for 8-1/2 inch by 11 inch punched pages, completely clear plastic covered for insertion of labels on spines and covers.

B. Provide identifying tabbed pages. Classify by Division and by Section. All tabbing shall be in numerical order.

C. Drawings:

1. Provide reinforced punched binder tab. Bind drawings with text.

2. Fan fold larger drawings to size of text pages, for easy foldout.

D. Cover: Identify each volume with typed or printed label, List:

1. Title of Project

2. Identify of separate structures as applicable.

3. Identify of general subject matter covered in the manual.

E. Spine: Identify each volume with typed or printed label stating OPERATING AND MAINTENANCE INSTRUCTIONS, GUARANTEES AND SERVICE CONTRACTS and the following information:

1. Title of Project.

2. Divisions and Sections included within volume.

3. Volume number (i.e. “1 of 4)

PART 3 – EXECUTION

3.1 CONTENT OF MANUAL

A. Table of Contents:

1. List of each product indexed to the content of the volume.

2. List with each product the name, address, and the telephone number of:

a. Subcontractor and installer.

b. Maintenance contractor, as appropriate.

c. Local sources of supply for parts and replacement.

B. Product Data: Annotate each sheet to clearly identify the data applicable to the installation. Delete references to inapplicable information

C. Drawings:

1. Supplement product data with Drawings as necessary to illustrate the following:

a. Relationship of component parts of equipment and systems.

b. Control and flow diagrams.

2. Do not include Project Record Drawings as maintenance drawings.

D. Instructions: Provide written text, as required to supplement product data for the particular installation.

E. Warranties, Guaranties, Bonds, and Service Contracts: Include a copy of each warranty, guarantee, bond and service contract issued.

1. Provide information sheet for the District’s personnel describing the following:

a. Propose procedures in the event of failure or emergencies.

b. Circumstances under which the validity of warranties, guaranties, or bonds might be compromised.

3.2 MANUAL FOR MATERIALS AND FINISHES

A. Instructions for Care and Maintenance: Include manufacturer’s data as follows:

1. Recommendations for types of cleaning agents and methods.

2. Cautions against cleaning agents and methods which are detrimental to the product.

3. Recommended schedule for cleaning and maintenance.

3.3 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Content, for each unit of mechanical equipment and system, as appropriate:

1. Description of Unit and Component Parts:

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

b. Performance curves, engineering data, and tests.

c. Complete nomenclature and commercial number of replacement parts.

2. Operating Procedures:

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

b. Regulation, control, stopping, shut-down, and emergency instructions.

c. Summer and winter operation instructions.

3. Maintenance Procedures:

a. Routine operations.

b. Guide to “trouble-shooting.”

c. Disassembly, repair, and reassemble.

d. Alignment, adjusting, and checking.

4. Servicing and lubrication schedule including list of lubricants required.

5. Manufacturer’s printed operating and maintenance Instructions.

6. Description of sequence of operation by control manufacturer.

7. Original manufacturer’s parts list, illustrations, assembly drawings, and diagrams required for maintenance, including:

a. Predicted life of parts subject to wear.

b. Items recommended to be stocked as spare parts.

8. Control diagrams by manufacturer of controls as installed in project.

9. Coordination Drawings and color coded piping diagrams.

10. Charts of valve tag numbers, with the location and function of each valve.

B. Content, for each electric and electronic system as appropriate:

1. Description of System and Component Parts:

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

b. Performance curves, engineering data, and tests.

c. Complete nomenclature and commercial number of replaceable parts.

2. Circuit directories of panelboards:

a. Electrical service.

b. Controls.

c. Communication.

3. As-installed color coded wiring diagrams.

4. Operating Procedures:

a. Routine and normal operating instructions.

b. Sequences required.

c. Special operating instructions.

5. Maintenance Procedures:

a. Routine operations.

b. Guide to “trouble-shooting.”

c. Disassembly, repair and re-assembly.

d. Adjustment and checking.

6. Manufacturer’s printed Operating and Maintenance Instructions.

7. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

3.4 INSTRUCTION OF THE DISTRICT’S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct the District’s designated operating and maintenance personnel in the operation, adjustment and maintenance of all products, equipment, and systems installed in project.

1. Provide services of factory trained instructors from the manufacturer of each major item of equipment or system.

B. Operating and maintenance manual shall constitute the basis of instruction.

1. Review contents of manual with personnel in full detail to explain all aspects of operation and maintenance.

2. Review instruction on how to efficiently use state required energy conservation features, materials, components, and mechanical device.

END OF SECTION

SECTION 02 41 19
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of the General and Supplementary Conditions and Division One apply to this section.

B. Section Includes: Furnishing all labor, materials and equipment necessary for demolition, dismantling, cutting and alterations as indicated, specified, and required for completion of the Contract, as applicable. Includes items such as the following:

1. Protecting existing work to remain.
2. Cleaning soiled materials that are to remain.
3. Disconnecting and capping utilities.
4. Removing debris and equipment.
5. Removal of items indicated on Drawings.
6. Salvageable items to be retained by the Owner as indicated on the Drawings and during the pre-construction job walk.

C. Related Sections:

1. Section 01 50 00: Temporary Facilities and Controls.
2. Section 31 10 00: Site Clearing.

1.2 QUALITY ASSURANCE

A. Comply with the following:

1. Applicable codes, ordinances, regulations of local, municipal, state and federal authorities having jurisdiction.
2. Obtain necessary permits and notices, post where required.
3. Comply with safety requirements of the local fire department.
4. Comply with ANSI A10.6.
5. Comply with Standard Specification for Public Works Const.

B. Demolition Firm Qualifications: Engage an experienced, licensed firm having a minimum of (5) years full time satisfactory experience in demolition work of similar scope and complexity to that indicated for this Project.

C. Notify affected utility companies before starting Work and comply with their requirements.

D. Carefully perform demolition work, by skilled workers experienced in building demolition procedures, using appropriate tools and equipment. Perform work, at all times, under the direct supervision of a supervisor approved by the Owner Inspector.

E. Coordinate demolition with other trades to ensure correct sequence, limits, and methods of proposed demolition. Schedule work to create the least possible inconvenience to the public and to facility operations.

F. Pre-Demolition: Conduct conference at Project site 7 days prior to scheduled installation.

1. Conference agenda shall include review and discussion of requirements of authorities having jurisdiction, instructions and requirements of serving utilities, sequencing and interface considerations and Project conditions.
2. Conference shall be attended by supervisory and quality control personnel of Contractor and all subcontractors performing this and directly related work. Submit minutes of meeting to Owner's Representative for Project record purposes.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to location as directed by Owner's Representative.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Owner's Representative, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original locations.

1.4 OWNERSHIP OF MATERIALS

A. Ownership of Materials: Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 PROJECT CONDITIONS

A. Drawings may not indicate in detail all demolition work to be carried out. Carefully examine existing conditions to determine full extent of demolition required. All utilities, whether shown on the drawings or not, to be capped at the property line U.N.O.

B. Repair damage due to demolition activities to existing improvements to remain at no additional cost to the Owner. Repair or replace as directed by the Owner Inspector.

C. Take measures to avoid excessive damage from inadequate or improper means and methods, or improper shoring, bracing or support. Repair or replace any resulting damage at no additional cost to the owner as directed by the Owner Inspector.

D. If conditions are encountered that vary from those indicated, notify the Owner Inspector for instructions prior to proceeding. Owner assumes no responsibility for actual condition of structures to be demolished.

E. Inform Owner immediately upon discovery of asbestos products, radioactive materials, toxic wastes or other hazardous materials. Do not remove hazardous materials without Owner authorization.

F. Adjacent roadways/passageways:

1. Maintain fire department access through all phases of the project.
2. Obstruction of streets, walks or other adjacent facilities will not be allowed.

1.6 DIG ALERT NOTIFICATION

A. Before any excavation in or near the public right-of-way, the Contractor must contact the Underground Service Alert of Southern California (Dig Alert) at 811 for information on buried utilities and pipelines.

B. Delineation of the proposed excavation site is mandatory. Mark the area to be excavated with water soluble or chalk based white paint on paved surfaces or with other suitable markings such as flags or stakes on unpaved areas.

C. Call at least Two (2) full working days prior to digging.

D. If the members (utility companies) have facilities within the work area, they will mark them prior to the start of your excavation and if not, they will let you know there is no conflict. A different color is used for each utility type (electricity is marked in red, gas in yellow, water in blue, sewer in green, telephone and cable TV in orange).

E. The Law requires you to hand expose to the point of no conflict 24" (inches) on either side of the underground facility, so you know its exact location before using power equipment.

F. If caught digging without a Dig Alert ticket you can be fined as much as $50,000 per California government code 4216.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Soils approved by the testing geotechnical engineer and free of rock or gravel larger than 4 inches in any dimension, debris, waste, vegetation and other deleterious matter and as approved by the Geotechnical Engineer. Rocks or hard lumps larger then approximately 4 inches in diameter should be broken into smaller pieces or should be removed from the site. It is anticipated that most of the on-site soils may be reusable as engineered fill after any vegetation, construction debris, oversized material and deleterious material is removed from the site.

B. Backfill & Native Fill Materials: The on-site soils may be reused as compacted engineered fill provided they comply to the requirements of “Satisfactory Soil Materials”, as described above.

C. Borrow / Imported Fill Material: Soil excavated from site or imported conforming to requirements for fill material.

D. Materials for the fill shall be free from vegetable matter and other deleterious substances, shall not contain rocks or lumps of a greater dimension than is recommended by the geotechnical consultant, and shall be approved by the geotechnical consultant.

E. Imported materials should have a Plasticity Index (PI) not less than 5 nor greater than 15, as determined by ASTM D 4318; and expansion index not exceeding 10, as determined by ASTM D 4829; and a particle size not exceeding 3 inches as determined by ASTM D 422.

F. Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 8 inches thick (loose measurements), and compacted to a minimum of 90% of the soil’s maximum dry unit weight.

G. Backfill Material for Trenches:

1. The on-site soils may be used for backfilling utility trenches from one foot above the top of pipe to the surface, provided the material is free of organic matter and deleterious substances. Any soft and/or loose materials or fill encountered at pipe invert should be removed and replaced with properly compacted fill or adequate

bedding material. Also, rocks larger than 6 inches and boulders should not be used as backfill.

2.2 HANDLING OF MATERIALS

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

B. Items scheduled for reuse shall be stored on site and protected from damage, soiling and theft.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection: Do not begin demolition until safety partitions, barricades, warning signs and other forms of protection are installed. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition. Provide and maintain fire extinguishers. Comply with requirements of governing authorities. Maintain existing utilities which are to remain in service and protect from damage during operations.

B. Safety: If at any time safety of existing construction appears to be endangered, take immediate measures to correct such conditions; cease operations and immediately notify the Owner Inspector. Do not resume demolition until directed by the Owner Inspector.

C. Noise and Dust Abatement: Exercise all reasonable and necessary means to abate dust, dirt rising and undue noise. Perform necessary sprinkling and wetting of construction site to allay dust as required by applicable codes and ordinances

D. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Do not create hazardous or objectionable conditions, such as flooding and pollution, when using water.

E. Water for Dust Control: Contractor shall obtain and pay for all water required for his dust control operations. This may include, but is not limited to, payment of deposits to utility for construction meter, and payment of all monthly service and water charges. Construction meter shall be in place throughout construction period unless alternative arrangements are made with the Water Department to provide construction water for all purposes. Contractor shall be aware of water moratoriums and restrictions, and shall immediately advise Owner of effects on construction schedules.

F. An 8 foot high, chain link fence, with visual screen and gates, shall be erected prior to any demolition operations at the construction limits perimeter. Coordinate the exact location with Owner. Comply with specification section 32 31 13: Chain Link Fence.

G. Debris Removal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level.

H. Progress Cleaning: Clean adjacent buildings and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing before start of demolition.

3.2 PREPARATION

A. Prevent movement or settlement of adjacent structures. Provide bracing and shoring as necessary.

B. Utilities:

1. The Drawings do not purport to show all below-grade conditions and objects on the site. Contractor shall perform field investigations as necessary to establish location of underground utility services and other features affecting earthwork.
2. Mark location of underground utilities on asphalt pavement with paint.
3. Disconnect and cap utility services; comply with requirement of governing authorities.
4. Contractor shall arrange and notify utility company in advance of date and time when service needs to be disconnected. Do not commence demolition operations until associated disconnections have been completed. Should utilities and other below-grade conditions be encountered which adversely affect the Work, discontinue affected Work and notify Owner's Representative and Architect and request direction. Unforeseen conditions will be resolved in accordance with provisions of the General Conditions of the Contract. Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner's Representative and Architect. Repair or replace all damaged utility lines and structures as directed by the responsible utility company or agency. Repair or replacement of damaged utility lines and structures whole location or existence has been made known to the Contractor shall be at no change in the Contract Time and Contract Price.

C. Structures to be demolished shall be inspected for hazardous materials. Such materials shall be removed and disposed of before general demolition begins.

D. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner's Representative and Authority Having Jurisdiction (AHJ). Provide temporary services during interruptions to existing utilities, as acceptable to Owner's Representative and to Authority Having Jurisdiction (AHJ).

3.3 EXPLOSIVES

A. Explosives: Use of explosives will not be permitted.

3.4 DEMOLITION

A. Demolition, General:

1. With certain exceptions, the Contractor shall raze, remove and dispose of all structures, paving, fences and other obstructions that lie wholly or partially within the construction limits identified on Drawings. The exceptions are utility-owned equipment and any other items the Owner/Documents may direct the Contractor to leave intact or re-use onsite. Cease demolition immediately if adjacent structures appear to be in danger.
2. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
3. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's Representative and Authority Having Jurisdiction (AHJ). Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
4. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition area.
    a. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

b. Protect existing site improvements, appurtenances, and landscaping to remain.

c. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

5. Structural Stability: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of buildings to be demolished and adjacent buildings to remain. Strengthen or add new supports when required during progress of demolition.

6. Below-Grade Construction: Demolish foundation walls and other below-grade construction, as follows:

   a. Remove below-grade construction, including foundation walls and footings, to at least 18-inches below grade, but at least to bottom of footing or foundation wall.

   b. Completely remove below-grade construction, including foundation walls and footings.

7. Filling Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition of buildings and pavements with soil materials according to requirements specified in Section 31 20 00 - Earthwork.

8. Damages: Promptly repair damages to adjacent facilities caused by demolition operations.

9. Unless otherwise indicated on the plans, remove all demolished material from the site and dispose of at approved disposal sites. Comply with all requirements for recycling of demolished material as called for in Division 1 of this Specification. The contractor shall obtain necessary permits for the transportation of material from the site.

3.5 REMOVAL OF EXISTING PLUMBING AND ELECTRICAL EQUIPMENT AND SERVICES

A. Remove existing plumbing and electrical equipment fixtures and services not indicated for reuse and not necessary for completion of work. Remove abandoned lines and cap unused portions of existing lines. The Contractor is responsible for completely surveying the site and locating all existing utilities, above and below ground, before contracting to perform the work.

B. Asbestos – Cement (A-C) Pipe Removal and Disposal: The plans for the project may indicate that existing asbestos-cement pipe is to be removed from the ground. Where so indicated the Contractor shall excavate with care, expose the pipeline and remove the A-C pipe to the nearest joint. Should the plans not call out the removal of the A-C pipe and A-C pipe is encountered, the Contractor shall obtain approval from the Owner as to whether or not the A-C pipe is to be removed or can be left in place. Cutting of the pipe shall only be done if absolutely there is no other way to expose the length of pipe to the nearest joint that be separated and the Owner approves the cutting of the pipe. Cutting of the pipe shall be done with a mechanical saw with a pressure water source to dampen the pipe and the dust from the cutting. To remove a coupling, the coupling may have to be broken in the trench. The pipe once removed from the trench may be broken for handling. The breaking shall be done within a plastic bagging or sheeting material to minimize the release of asbestos fibers into the atmosphere. Once removed and broken, if necessary, the A-C material shall be bagged and disposed of legally with the Owner to be given a copy of all Contractor paperwork as to the legal disposal of the material. If the A-C pipe section(s) are removed intact the pipe can be removed by the Contractor from the project site and become the property and responsibility of the Contractor.

3.6 CLEANING

A. Clean existing materials to remain, using appropriate tools and materials.

B. Protect adjacent materials and equipment during cleaning operations.

3.7 PATCHING AND RESTORATION

A. Patching: Where removals leave holes and damaged surfaces that will be exposed in the completed construction, such holes and damaged surfaces shall be patched and restored to match adjacent finished surfaces.

1. Where new finish construction is applied over existing holes and damaged surfaces, patching and restoration shall be performed to the extent to make the substrate suitable for the provision of new finish construction.

2. Surfaces of patched and restored areas shall be flush with the adjacent existing surfaces and shall closely match existing adjacent surfaces in texture and finish.

B. Restoration of Site Finishes:

1. Concrete paving: Where it is necessary to excavate a trench across make a cut in concrete paved areas, cut concrete cutting saw, full depth of paving.

2. Bituminous paving: Where it is necessary to excavate a trench across make a cut in bituminous paved areas, either first score paving with a concrete cutting saw, in neat straight lines, prior to removing paving or make straight cuts with pneumatic spade.

3. Restoration of paving: Restore all paved areas to their original condition using material of like type and quality as the removed paving. Paving in public ways shall conform to applicable requirements of authorities having jurisdiction. Repaired surfaces shall match existing adjacent paving except minimum depth shall be 3-1/2 inches where existing paving is less than 3-1/2 inches.

4. Restoration of landscape planting: Restore soil and plant materials to match original condition, including additional topsoil, topsoil grading and preparation, new plant materials and plant maintenance during establishment period.

3.8 MAINTENANCE

A. Install and maintain all erosion control devices, including sandbag and gravel bag dikes, silt fences, de-silting basins, inlet barricades, vehicle wash traps, and other features as required per Specification Section 01060.

3.9 CLEAN-UP/DISPOSAL

A. Coordinate building access with the Owner Inspector. Review and schedule waste storage and removal, include truck access to site.

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

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

D. Remove waste and debris, other than items to be salvaged. Turn over salvaged items to Owner, or store and protect for reuse where scheduled. Continuously clean-up and remove items as demolition work progresses. Do not allow waste and debris to accumulate in building or on site.

END OF SECTION

SECTION 03 20 00
REINFORCING STEEL

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. Reinforcing steel (rods and mesh) for cast-in place concrete.

2. Accessories such as chairs and tie wires.

B. Related Work:

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

2. Reinforcing Steel for CMU: Reference Section 04 22 00.

1.02 SUBMITTALS

A. Procedure: In compliance with Section 01 33 00.

B. Show Drawings: Submit reinforcement shop drawings for record.

C. Shop Drawings: Submit shop drawings for reinforcement, prepared by a California-registered civil or structural engineer, for fabrication, bending, and placement of concrete reinforcement. Comply with ACI SP-66 “ACI Detailing Manual,” showing bar schedules, stirrup spacing, diagrams of bent bars, and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete or masonry structures.

1. Submit bar drawings and schedules with the corresponding placing diagrams. Drawings shall be complete for any specific area of Project when submitted.

D. Mill Reports: Submit copies of mill reports and test data for reinforcing steel sampled and tested, prior to starting this work.

1.03 QUALITY ASSURANCE

A. All work shall conform to 2016 Edition of California Building Code as well as Title 24, all Sections of California Code of Regulations.

B. Testing and Reinforcing: Shall comply with CBC 1705A.2, 1705A.3, 1705A4, 1905A, & ACI 318 as applicable. Laboratory Testing is required for all #5 and larger bars to meet requirements of ASTM A 615 or ASTM 706 as applicable. Comply with ACI 318:3.5.2 & AWS D1.4 for welded reinforcement.

C. Inspection: Required after placement of steel for all structural concrete, by IOR (Inspector of Record).

1.04 HANDLING

A. Procedure: In compliance with Sections 01 10 30 and 01 20 30.

B. Electrode Storage: Comply with the combined recommendations of AWS and the electrode manufacturer for storage of electrodes. Do not use electrodes that have been wetted.

C. Delivery: Deliver reinforcement to the site bundled, tagged and marked; handle to prevent damage to material. Use metal tags indicating size, length and other markings shown on placement drawings. Maintain tags after bundles are broken.

D. Store materials at the Project Site to prevent damage and accumulation of dirt and excessive rust.

2.00 PRODUCTS

2.01 REINFORCING STEEL

A. Clean, new stock conforming to specifications below.

B. Rebars:

1. Typical: ASTM A 615; deformed: Grade 60; #4 and smaller ties and stirrups may be grade 40, unless noted otherwise.

2. Welded: ASTM A 706, Grade 60.

C. Welded Wire fabric (mesh): ASTM A 185.

D. Tie Wire: ASTM A 82, 16 gage (minimum) annealed steel wire.

E. Welding Electrodes: AWS A5.1 E70XX Series, low hydrogen, having a minimum yield point of 70,000 psi.

F. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire-bar-type supports complying with CRSI specifications.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs, or precast concrete block chairs with embedded wire ties.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

3. Over waterproof membranes and vapor barriers, use precast concrete chairs to prevent puncturing of membrane.

3.00 EXECUTION

3.01 TOLERANCES

A. Conform to those specified in CRSI Manual of Standard Practice for both fabrication and placing tolerances. Refer also to Drawings.

3.02 FABRICATION

A. Conform to CRSI Manual of Standard Practice. Fabricate in sizes, grades, lengths and bend to shapes indicated on the drawings. Use standard bends using bending tables. Bend bars cold. In case of fabricating errors, do not rebend or straighten reinforcement in a manner that will injure or weaken the material.

B. Reinforcement with any of the following defects will not be permitted in the Work:

1. Bar lengths, depth and bends exceeding specified fabrication tolerances;

2. Bends or kinks not shown on Drawings; Bars with reduced cross-section due to excessive rusting or other cause.

3.03 SOURCE QUALITY CONTROL

A. Submit to the Testing Laboratory copies of mill certificates, for all types and sizes of reinforcing steel, showing the following information:

Source of Steel	Ultimate tensile strength
Description	Elongation percentage
Heat number	Bend test
Yield point	Chemical analysis

B. When materials cannot be identified, the Testing Laboratory will make one series of tests (tensile and bend) from each 2.5 tons, or fraction thereof, of each size and kind of reinforcing steel. Payments for tests shall be borne by the Work of this Section. Make tests on a minimum of 2 separate samples. Sample length: Sufficient to allow tests to be made on as-rolled bar.

3.04 PLACING REINFORCING STEEL

A. General: Provide reinforcing steel in sizes, lengths and bent to shapes as indicated on the drawings; thoroughly cleaned of loose mill scale, rust, oil and all coating will destroy or reduce the bond before placing, and again before concrete is placed. Steel shall be accurately positioned and secured in place.

B. Placing: Comply with the listed reference standards as applicable.

1. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.

2. CRSI, Manual of Standard Practice.

3. AWS D1.4, Structural Welding Code – Reinforcing Steel.

C. Support: Use dense grooved concrete blocks with embedded wire ties to hold reinforcement above earth at proper distance. Approved wire chairs or bolsters for support of reinforcement in forms in conformance with applicable requirements of CRSI. Provide construction bars to properly space and support steel that is not supported by other means. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations.

D. Installation: Conform to ACI 315 and as follows:

1. Reinforcement shall be wired together sufficiently to securely maintain position and shall be lapped as shown or specified. Splices in general shall be staggered.

2. Care shall be taken to maintain proper clearance, 1-1/2-inch minimum between parallel bars (except bars may be tied together at splices).

3. Lapped splices shall be made in a manner to provide laps required by structural drawings.

4. Dowels and bars extending through construction joint shall be secured against displacement before concrete is placed and shall be cleaned of concrete adhering thereto immediately after pour, while encrustations are soft.

E. Field Bending: Bars #4 and smaller may be cold bent in the field provided bends are made with proper bending devices and bends conform to drawings for dimension and CRSI Standards for radius and detail. No bar shall receive more than one bend at any single location for any reason.

3.05 WELDING

A. Welding: Comply with the requirements of AWS D1.4. Before welding, determine the weldability of reinforcing bars by laboratory chemical analysis of the steel. Only steel conforming to the chemical requirements specified in AWS D1.4 may be welded.

B. Welded Splices: Use full penetration butt welds made by the electric-arc method unless indicated otherwise.

1. Use only welders who have passed the AWS standard qualification tests within the previous year.

2. Weld splices shall develop 125% of the specified yield strength of the reinforcing bars, or of the smaller bar in transition splices.

3. Clean bars of oil, grease, dirt and other foreign substances, and flame-dry before welding.

4. Prepare ends of bars in compliance with AWS D1.4. Preheat bars before welding.

END OF SECTION

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

1.00 GENERAL

1.01 DESCRIPTION

A. Principal work in this Section:

1. All Concrete. Concrete mix designs.

2. Formwork.

3. Placement, curing and jointing of concrete and grouting and sacking of concrete surfaces.

4. Setting anchor bolts and dowels.

5. Setting screens and fine grading for slabs on grade.

6. Concrete finishes.

7. Grouting of hollow metal door frames at rated openings.

B. Related Work:

1. Reinforcing Steel: Section 03 20 00.

2. Vapor Barrier Under Slabs-On-Grade: Reference Section 07 26 00.

3. Sleeves, pipes, conduit, hangers, inserts, ties, anchors and miscellaneous hardware to be furnished and located by trades requiring the same.

1.02 REFERENCE STANDARDS

A. ACI 211.1, Recommended Practice for Selecting Proportions - Normal and Heavyweight Concrete.

B. ACI 347-R, Recommended Practice for Concrete Formwork.

C. ACI 305, Hot Weather Requirements.

D. ACI 304, Measuring and Mixing.

E. ACI 308, Compacting and Vibrating.

F. ACI 309, Curing.

1.03 QUALITY ASSURANCE

A. Refer also to Section 01 10 60: All work shall conform to 2016 Edition of

California Building Code and State Building Code, Title 24.
Concrete (Chapter 19A).

B. Materials:

1. Portland Cement Tests - ACI 318, 1903A.5, 1903A.6, & 1905A

2. Concrete Aggregates - 1903A.6 & 1905A

3. Reinforcing Bars - 1903A.4, 1905A

4. Batch Plant Inspection – 1705A3.3 & 1705A3.3.1

C. Concrete Quality:

1. Proportions of Concrete – ACI 318 & 1905A.1.

2. Strength Tests of Concrete - 1905A.1.16.

D. Concrete Inspection:

1. Job Site Inspection – Table 1705A.3.3

2. Batch Plant or Weighmaster Inspection – 1705A3.2 & 1705A3.3

E. Tests: All concrete materials shall be tested or certified and reported prior to any use of same.

F. Portland Cement: Shall be mill-tested cement. Certifications of compliance furnished for each shipment of cement, otherwise cement shall be tested by the testing Laboratory.

G. Aggregate Required Tests for Mix Designs: One for job unless character of material changes, material is substituted, or at the request of the Architect.

1. Sieve analysis per ASTM C136.

2. Specific gravity per ASTM C127 and C128, minimum value 2.60.

H. Aggregate Optional Tests: Only if required by the Architect because of questionable materials or sources.

1. Soundness per ASTM C88.

2. Abrasion, L.A. Rattler, ASTM C131.

I. Design Mixes: After acceptance of aggregate and whenever character or source of materials is changed, the laboratory shall furnish mix designs in accordance with ACI 211.1 and CBC 1905A. Mix designs shall indicate the source of aggregates and brands of cement and admixtures used. Mixes designed for pump placement shall be identified as such. Provide mix design for all other compression strengths and detailed uses indicated on the drawings. Contractor shall pay testing laboratory for these design mixes.

J. Molded Concrete Cylinders: 1 set (3) of molded cylinders, each sampling per ASTM C172, made by Laboratory Inspector, for each 50 cubic yards of each day's pour or fraction thereof. One 7 and two 28 - days cylinders shall be prepared and cured in the laboratory per ASTM C31. Cylinders shall be tested for compression per ASTM C19 and shall exhibit the following strengths:

Designation	7 Day	28 Day
3000	2000	3000

K. Core Tests: Only if ordered by the Architect on the basis of deficient cylinder tests or other conditions indicating defective concrete. Cores, if required, shall be cut from locations directed by the Architect, secured per ASTM C42, prepared and tested by ASTM C39. Results of core tests to be evaluated by the Architect. In general, they will be expected to exceed the 28-day specified strengths.

L. Batch Plant Inspection: By Laboratory Inspector. Continuous inspection required for all structural concrete. Bonded Weighmaster affidavits acceptable for slab and non-structural concrete.

M. Placement Record: A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure, and shall be open to the inspection of the enforcement agency.

N. Field Quality Control: Perform work of this Section under the supervision of a capable concrete superintendent. Continuously monitor concrete placing operations to maintain level floors by use of an instrument level, transit or laser.

O. Mock-Up: Before beginning work, cast a 10 ft. x 10 ft. sample panel of the exposed aggregate concrete at a location on the site agreed upon with the Architect.

1. Use same concrete mix, placing, consolidating and finishing methods and workmen as for the finish work.

2. Protect panel until its removal is authorized by the Architect. Make such modifications as necessary to achieve a panel satisfactory to the Architect.

3. Approved panel shall serve as the standard for all remaining work. Remove panel only after completion and acceptance of exposed aggregate flatwork.

2.00 MATERIALS

2.01 CONCRETE:

A. Portland Cement: ASTM C150, Type II, low alkali.

B. Aggregates: ASTM C33 and C330 for expanded shale and as specified. Each

size graded and batched separately. From approved pits.

1. Fine Aggregate: Washed natural sand or hard strong particles, and shall contain not more than 1% deleterious material and not more than 2.5% shall pass the No. 200 sieve.

2. Coarse Aggregate: Clean sound washed gravel or crushed rock, evenly graded. Crushings may constitute not more than 30% of the total volume. Not more than 5% flat, thin, elongated or laminated material. Not more than 1% deleterious substances.

3. Alkali Reaction: Do not reactivate aggregate nor use aggregates that are alkali reactive when tested in accord with ASTM C127, ASTM C289, or ASTM C295.
4. Maximum coarse hardrock aggregate size:

   a. General: 1”

   b. In slabs on grade: 1”

5. Hardrock Concrete: Washed sand gravel (from acceptable pits), ASTM C33, including requirements for sampling and testing.

C. Admixtures: Water-reducing admixture conforming to ASTM C494 shall be used in all slab and superstructure concrete. Foundation concrete optional.

D. Fly Ash: Conform to ASTM A618, Class C or F. Fly ash shall not exceed 12 percent of total cementitious material by volume.

E. Water: From domestic sources, clean and free from harmful amounts of acids, alkalis, oil, organic or other deleterious materials and with no pronounced taste or odor.

F. Curing Compound:

1. Liquid membrane-forming compound complying with ASTM C309, Type I (1D), Class B, guaranteed not to affect the appearance of the concrete surfaces, and the bond, adhesion, or effectiveness of finishes and surface treatment specified herein to be applied to concrete.

2. Curing compound used on exposed concrete surfaces shall be non-discoloring, fast drying and shall be conclusively demonstrated not to darken or yellow with age.

3. Curing compound for use on concrete floors to receive adhered covering shall be specially formulated for such use and shall be certified by the manufacturer not to inhibit the bonding qualities of flooring adhesives.

G. Surface Retarder: Rugasol C/S by Sika Chemical Corp. or True Etch Surface Retarder by Burke Co.

H. Abrasive Aggregates: Silicone carbide 12/30 grading, aluminum oxide 14/36 grading or emery grits made by one of the following manufacturers. Use only

one type on Project.

1. Conrad Sovig Co., Inc.

2. Chemrex, Inc./Sonneborn.

3. Carborundum Co.

4. Norton Co.

5. Anti-Hydro Co.

6. L&M Construction Chemicals, Inc.

I. Structural Adhesive: ASTM C881, 2-component material suitable for use on dry or damp surfaces. Provide material “Type”, “Grade”, and “Class” to suit project requirements.

1. Rezi-Weld 1000 by WR Meadows.

2. Thiopoxy by WR Grace.

3. Sikadur Hi-Mod by Sika Chemical Corp.

4. Patch and Bond Epoxy by The Burke Co.

J. Sealer: One of the following:

1. Cure-Hard by WR Meadows (sodium silicate).

2. Ashford Formula by Curecrete Chemical Co. (sodium silicate).

3. Lapidolith by Sonneborn (magnesium or zinc fluosilicate).

4. Chem Hard (magnesium fluosilicate), Fluohard (magnesium fluosilicate) or Seal Hard (siliconate/sodium silicate) by L&M Construction Chemicals, Inc.

5. Saniseal 50 by Master Builders Co. (magnesium or zinc fluosilicate).

K. Expansion Joint Materials:

1. Joint Filler: Use in combination with plastic joint cap made by Greenstreak, Quaker Plastic Corp., WR Meadows, or equal.

   a. Homex Expansion Joint by Homasote Co., or equal non-bituminous product compatible with sealant specified in Section 07920.

   b. Sealtight self-expanding cork by WR Meadows, or equal compatible with sealant specified in Section 07920.

2. Joint Sealant and Back-Up Rod: As specified in Section 07920.

L. Non-Shrink Grout: As hereinafter specified.

2.02 FORMWORK:

A. General: All forming materials shall be new material at the beginning of this project. Materials may be re-used during the progress of the job provided they are capable of producing the formwork requirement for that use.

B. Studs, Wales, Shoring, Centering, Bracing: "No. 2" grade or better D.F. of designed adequate size utilizing doubled wales.

C. Unexposed Surfaces: Unoiled DFPA "Plyform B-B"; Douglas Fir "Standard", "T&G" or "Shiplap" boards, and patented modular forms.

D. Exposed Surfaces: Use APA Ext. Plyform B-B, unoiled. Columns: Smooth plastic coated fiber or Jefferson Smurfit or MFG by Burke Company.

E. Chemical, surface-conversion type form release agent: Shall be applied and reapplied for each reuse to new and cleaned forms. "Nox-Crete Form Coating" by Nox-Crete Chemical, Inc., "Formshield" by W.R. Grace & Company, "Release" by the Burke Co., are acceptable.

2.03 NON-SHRINK GROUT

A. Required for setting bolts, base plates, and dowels in new and existing concrete. Grout shall be Sika Grout 212 as indicated on Drawings. Use in accord with manufacturer's directions. The grout shall be pre-mixed and shall require only the addition of water at the Project Site. Properly clean all existing surfaces of foreign materials prior to grouting operations.

B. Dry Pack: Specified on Drawings, Sheet S-1.

3.00 EXECUTION

3.01 FORM CONSTRUCTION

A. Shall conform to ACI 237 and to the following additions and clarifications:

1. Tolerances: The tolerances shown in ACI 347 shall govern.

2. Plywood: Forms used for exposed concrete shall have all joints level, backed by studs or blocking, filled and sanded smooth. Holes for ties in forms shall be 1/16 inch maximum oversize to prevent leakage of paste.

3. Chamfer corner of all exposed concrete as indicated or as directed, using milled, tightly-set wood chamfer strips or pre-molded rubber strips.

4. Wood and other below-grade formwork shall be completely removed.

5. Coordination: Provide slots, openings, chases, recesses, grounds, nailers and screens required by other trades and subsequent work. Assure that they are secured in forms before placement of concrete.

6. Wood in forms: No wood, temporary or permanent, to be used or installed inside forms, except for item specified.

7. Sides or footings may be formed by neat excavations if banks will stand without caving and the neat trenches are cut 1 inch wider each side than footing dimensions on drawings. Protect edges of excavations with planks staked in place. If banks cave, widen trenches and form footings.

3.02 CONSISTENCY

A. Water shall not exceed amount permitted in mix designs. To be checked by the slump test, ASTM C143, made when test cylinders are cast, and additionally as required. Maximum slumps are indicated on the Drawings.

3.03 MIXING OF CONCRETE

A. Mix concrete by transit mixers only in accordance with ASTM C94, unless otherwise specified.

B. Mixing Time: At least 3 minutes after all water is added to mixture not less than one minute of which is immediately prior to discharge at Project Site.

C. Final Position: Place transit mixed concrete in final position within 1-1/2 hours after water is first added to the batch, and at the time of placing, the concrete shall be in such condition that it will flow readily into position. Retempering is not permitted.

D. Water: Concrete at point of delivery shall have 1-1/2 gallons per cubic yard of required water withheld to be added at job site. Mix 5 minutes minimum after last water added.

E. Load Tickets: In addition to Contractor's copy, legible copy of all load tickets from manufacturer shall be delivered to the Laboratory with each load stating quantities of all constituents in each load, bearing signature of the Weighmaster. Contractor shall keep record of his copy, slump and location in structure of each load and keep all tickets at the job.

F. Certification: Transit mixed concrete supplier shall be a manufacturer licensed by the governing municipality. The manufacturer of transit mixed concrete shall deliver to Project Site a delivery ticket with each mixer truck. These delivery tickets shall specify type of concrete and weight of materials as noted in mix design and shall be signed by a State Licensed Weighmaster.

3.04 SLAB CONTROL JOINTS

A. Joint Spacing: Exterior - provide joints at 16 ft. maximum spacing. Locate joints coincident with architectural building features and as directed by the Architect.

B. Interior Slab Control Joints at Locations Indicated: Install specified control joint simultaneously with slab floating operation in conformance with manufacturer's directions. In general, locate at 20 feet on center maximum.

3.05 CONSTRUCTION JOINTS

A. Provide construction joints at locations required. See plans for joint detail. Subject to prior approval of the Architect.

B. Obtain approval of where placing of concrete shall stop or start. The flow surface of freshly poured concrete shall be level whenever any pour is stopped, with tight dams as necessary to accomplish this. Provide keys and dowels at construction joints where that concrete pour is interrupted. Properly prepare clean, rough joint surfaces.

C. Make construction joints at points shown or as acceptable to the Architect.

D. Permit no concrete to harden on any portion of forms or reinforcement prior to final depositing of concrete.

E. Pours, compact and rod floor slabs to the level and thickness shown.

3.06 ANCHORAGE MISCELLANEOUS METAL AND INSERTS

A. Provide and install, or install those provided by others, accurately, in sizes and in locations shown or required.

1. No pipes permitted in slabs. Conduits over 1/4 slab thickness not permitted. Thicken slab locally to permit this. Conduit in slabs to be middle 1/2 of section. Conduit and piping below slab on grade to be encased in belled slab. Provide sleeves for pipes or conduit required to pass through footings as indicated on the Drawings.

3.07 CONVEYING AND PLACING CONCRETE

A. Clean and wet forms before placing concrete, and clean excavations of loose material.

B. Pouring Against Hardened Concrete Surfaces: Remove laitance and encrustation and expose solidly embedded sound aggregate. Thoroughly wash and moisten previously placed concrete surfaces before placing new concrete.

1. Contact surface may be washed with clean water under pressure (jet blast), may be sandblasted, or in areas which will be concealed from view when the building is completed an approved structural adhesive may be used on clean, structurally sound concrete. Remove wash water entirely from surface.

C. Method of Placing: As nearly as possible in final position with minimum handling. Free drop, not more than 4 feet. Use pump, tremies, spouts, dump boxes and ports in formwork to reduce drop.

D. Placing: Comply with requirements of ACI 301. Keep concrete as level as possible, with a minimum flow from one portion of the work to another. Place concrete with a workable, non-segregating mixture. Tamp and vibrate so as to produce a dense smooth job, free from rock pockets and voids. Use acceptable trunks and chutes where free drop exceeds 6 feet.

E. Pumped Concrete:

1. General: Do not use aluminum or joint lined pipe. Prevent concrete from contacting aluminum fittings.

2. Mix: Do not add more water to mix than maximum allowed on delivery ticket when a slump desired is greater than that initially in pump. Check that mix design entered on delivery ticket complies with that ordered.

3. Pumps: Use only piston type pumps. Insure that they are reversible. Make standby pump available of no less capacity than that in use for operation at the Project Site within one hours' notice.

3.08 PUMP METHOD OF PLACING

A. Concrete mix shall conform to requirements of these specifications, designed specially for pump placement and shall contain a proportion of fine aggregate not greater than 47% of the total aggregate volume, by loose dry volume, and shall entrain not more than 5% air.

B. Capacity: Pumps used shall have a demonstrated capacity to deliver to the forms not less than 22 cubic yards per hour of the types of mixes required by these specifications, at the specified slumps, under average job conditions or those required by this work. Regular field service records shall be the only acceptable evidence. Do not use grout pumps for any concrete.

C. Specified slumps shall not be exceeded and shall be frequently checked at both the pump and discharge ends. Slumps at both ends shall agree within 1 inch. Governing slump shall be that obtained at the discharge end.

3.09 PLACEMENT OF CONCRETE SLABS

A. Preparations: Fine grade subgrades smooth and level and sprinkle well just prior to placing concrete. Broom and wash clean from surfaces, leaving no standing water. Place screed on adjustable screed support systems that will provide accurate support and will not penetrate the vapor barrier. Verify that all reinforcing steel and other embedded items are in correct position and properly secured.

1. Surface Preparation: Before concrete is deposited upon or against concrete that has taken its initial set or has hardened, remove all encrustation from the forms and reinforcement, and mechanically roughen hardened concrete to minimum 1/4 inch coarseness amplitude.

a. Remove all laitance, oil, and loose particles from concrete; clean concrete surfaces and forms thoroughly by washing with water under stiff pressure, or sandblasting, if necessary, to obtain the specified condition.

b. Remove laitance after concrete has partially hardened (not less

than two nor more than four hours after placing) by brushing with stiff bristles or by directing a stream of water from a 1/4 inch nozzle, or other acceptable method, to expose clean top surface of aggregate.

c. Where cleaning is not satisfactory to the Architect, sandblast surface and then wash again.

B. Placement: Place at a rate not faster than concrete can be properly leveled and compacted, and at point of final repose, directly ahead of the screed bar, vibrating mass just ahead of the screed. Screed twice, the first to strike a full, rough level and move the concrete mass ahead. Follow this with necessary filling of low areas and another screeding to final level. Remove any puddles of "soup", pull screeds and screed supports and fill all depressions, and tamp with flat-surface or mesh tamper only enough to embed coarse aggregate to permit finishing, a maximum 1/8 inch, allowing as much time between tampings as weather conditions will allow.

C. Leveling and Floating: Level using only wood or magnesium surfaced leveling floats. Steel flat blades shall not be used. Commence fog spray curing as specified below directly following this operation. Allow to stand until water sheen disappears from surface. Power float surface to even surface, producing levels or slopes indicated on Drawings. Surface tolerance to be true to within 1/4 inch in 10 feet, any direction. Follow with trowelling or other finishes as specified.

3.10 COMPACTING AND VIBRATING CONCRETE

A. Compact all concrete by vibrating with high-frequency vibration equipment producing not less than 10,000 cycles per minute to assure uniform density, aggregate distribution, and that mix reaches all parts of the form and encloses all reinforcing, hardware and inserts. Compacting and vibrating of concrete shall be as specified in ACI 308.

B. Vibration: Vibrate all concrete placed. Do not vibrate steel or forms. Do not transport concrete in forms with a vibrator. Use vibrators in horizontal position only in slabs and shallow sections and do not drag.

1. Vibrate in uniform vertical penetrations spaced about 12 in. o.c., rapidly plunging the vibrator to the bottom of preceding lift, then slowing withdrawing in an upward and downward motion until the top of the vibrator head appears at the surface of the concrete.

C. Re-Vibration: Place concrete containing retarding admixture, if approved, by a schedule that allows layers of concrete to be in place and compacted for at least 30 minutes before next layer of concrete is placed. Remove bleed water on the concrete surface and from forms and re-vibrate the concrete down as far as the concrete is plastic before placing the next layer.

D. Correction of Segregation: Before placing next layer of concrete, and at top of last placement for vertical elements, remove concrete containing excess water or fine aggregate or showing deficiency of coarse aggregate and fill the space with compacted concrete of correct proportions.

E. Slabs: Compact and tamp concrete and bring 1/8 to 1/4 inch of mortar to surface. Wood float to straightedges and screeds. Do not use steel or plastic floats of any kind for initial floating operations. Do not apply finish until all surface water disappears and surface is sufficiently hardened. Remove bleed water and laitance as it appears.

3.11 CURING OF CONCRETE

A. Cure all concrete for at least 10 days. Forms maintained tight and wet are considered adequate curing. Fresh backfill is adequate curing for subgrade walls and foundations. Exposed concrete surfaces shall be cured by use of fine mist-type fog spray continued without interruption until the final trowellng when concrete has attained final permanent set and bleeding has stopped. Then apply specified liquid membrane curing material in strict accordance with the manufacturer's instructions. Curing of concrete shall be as specified in ACI 309.

B. Adequately protect all exposed concrete surfaces from damage which might result from work of other trades, on or about the Project, until final acceptance of the Work. Comply with applicable ACI requirements to secure satisfactory concrete in either hot or cold weather.

3.12 REMOVAL OF FORMS

A. Forms, shoring and centering shall not be removed until concrete has cured sufficiently to permit safe removal. Shoring shall not be removed until the member shored has acquired sufficient strength to support its weight and the load upon the member including all construction loads. When forms are stripped there must be no excessive deflection or distortion and no evidence of damage to the concrete, due either to removal of support or to the stripping operation. When forms are removed before the specified curing is completed, measures should be taken to continue the curing. Conform to the following stripping times unless modified by the Architect or safety requirements are greater:

1. Footings and footing walls - 2 days

2. Walls - 24 hours

3. Columns - 24 hours

B. Take care in removing forms from exposed surfaces that surfaces are not marred or gouged, that corners are true, sharp and unbroken. Break back snap ties or disassemble 3-part ties, without spalling tie holes.

C. No steel spreaders, ties or other metal shall project from or be visible on any concrete surface.

3.13 FINISHING FORMED SURFACES

A. Surface of formed concrete which will remain exposed in the finish work, both interior and exterior, including surfaces which will be painted, shall, when

finished, have surfaces uniform for the intended texture; free from imperfect joints, fins, "honeycombing", air pockets or "bug" holes, or other such imperfections.

B. Remove rough spots, stains and hardened mortar or grout from intended smooth surfaces by rubbing such surfaces lightly with fine carborundum stone. Use liberal amount of water and rub sufficiently to remove defects without changing texture of concrete while concrete is green, immediately after specified form removal.

C. If intended smooth surfaces are not uniform texture, treat as follows:

1. Prepare mix consisting of one part portland cement, 1-1/2 parts fine sand, and sufficient water to product a grout of the consistency of thick paint.

2. Wet surface to be treated and apply grout uniformly with a brush, completely filling air bubble holes. Immediately float, scouring the surface vigorously. Allow cement grout to partially set for an hour or two, depending on weather.

3. When grout has sufficiently hardened so it can be scraped from surface with the edge of a steel trowel without removing grout from small air holes, cut off all that can be removed with a trowel, allow surface to dry thoroughly, then rub vigorously with burlap to completely remove surplus.

4. Further finish exposed intended smooth surfaces, if necessary, by means of honing with a carborundum stone to uniform surfaces as acceptable to the Architect.

5. Complete entire operation for any area the day it is started.

6. Do not use dry cement sacking.

3.14 CURING VERTICAL SURFACES

A. Thoroughly wet forms containing concrete, including the tops and exposed portion of concrete, and maintain in a thoroughly moist condition until the forms are removed, but not less than 7 consecutive days from time of placing concrete.

1. Continuously wet concrete between the hours of 8:00 a.m. and sunset each day, including Saturday, Sunday, and Holidays, for the first 4 days, and not less than 3 times daily for the 3 remaining days until the concrete reaches design strength.

3.15 CONCRETE SLAB FINISH

A. Interior - Trowelled per paragraph 3.09C.

B. Exterior Slabs:

1. Typical: Medium broom non-slip.

2. Abrasive aggregate (slip-resistant) finish for stair treads and landings where applied finishes are not used.

   a. Broadcast abrasive aggregate on the concrete, after first troweling operation uniformly at the rate of 25 lbs. per 100 sq. ft. Use caution not to bury the abrasive aggregates during second troweling.

   b. After second troweling, rub surface with pads of steel wool to remove film of cement and expose the abrasive aggregates, or as an option etch concrete with a 10% solution of muriatic acid followed by flushing with water to remove all traces of acid and expose the abrasive aggregates.

C. Markings:

1. At expansion joints and elsewhere as indicated, mark slabs with a 1/4 inch radiused edging or marking tool. In textured work edge and mark slabs, after texturing, with a combination edging/smoothing tool approximately 1-1/2 inch wide.

2. Where saw cutting is indicated, time this operation so that it is performed as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by the saw, but before shrinkage stresses have developed sufficiently to produce cracking.

3. Make marking lines straight, or curved as indicated, equally spaced and parallel to adjacent lines and/or walls, edges and other construction, and of uniform depth and cross section, with intersections accurately formed.

3.16 DEFECTIVE CONCRETE

A. Concrete work that is not formed as shown, is not true to intended alignment, not plumb and level where so shown, not true to line or grade, or which has irreparable voids or rock pockets, wood or debris embedded in it, or does not fully conform to these Specifications, will be deemed faulty material and workmanship.

1. Remove such work from Project Site and replace with concrete complying with requirements of these Specifications, at no extra cost to the District.

B. If compressive tests of concrete cylinder specimens fail to show compressive strength specified, the Architect may require tests to be made of core samples taken from the placed concrete represented by the unsatisfactory test samples and shall be paid by the Contractor for testing.

1. Take and test in accord with ASTM C42.

2. If the results of core tests show that the compressive strength is less than specified, concrete will be deemed defective, and shall be replaced in a manner acceptable to the Architect, at no extra cost to the Owner.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

2. Steel weld plates and angles for casting into concrete.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.

2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than **25** percent.

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

C. Steel Tubing: ASTM A 500, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm).
2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 (Grade 230)], with G90 (Z275) coating; 0.079-inch (2-m nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33 (Grade 230); 0.0677-inch (1.7-mm) minimum thickness; hot-dip galvanized after fabrication.

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Division 9 painting Sections.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize **exterior** miscellaneous steel trim.

2.9 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Division 9 painting Sections

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Division 9 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Supply and install Rough Carpentry work as indicated.

1.2 RELATED SECTIONS

A. Section 01 43 00: Quality Control.

B. Section 01 45 29: Testing and Laboratory Services.

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

D. Section 06 20 00: Finish Carpentry.

E. Section 09 29 00: Gypsum Board.

1.3 SUBMITTALS

A. Submittals: Submit in accordance with Section 01 33 00.

1.4 QUALITY ASSURANCE

A. All work shall be performed in accordance with the local codes and the most current DSA requirements. Where there is a question between the specifications, Architect/Contractor shall conform to the most constrictive requirement.

B. Douglas fir, larch or hemlock structural and framing lumber shall be graded in accordance with the "Standard Grading Rules" of the West Coast Lumber Inspection Bureau (WCLIB) or the "Western Lumber Grading Rules" of the Western Wood Products Association (WWPA) latest editions.

C. Redwood structural and framing lumber shall be graded in accordance with "Standard Specifications for Grades of California Redwood Lumber" of the Redwood Inspection Service, latest edition.

D. Each piece of lumber shall bear official grade mark of the association under whose rules it was graded, or official grade mark of another recognized grading agency using grading rules herein specified.

E. All 2x structural and framing members shall be air-dried to a moisture content not to exceed 19% before use.

F. Work of this Section shall comply with provisions of current edition of UBC and Title 24, see Section 01 45 29: Testing and Inspection.

G. Plywood shall conform to requirements of "Product Standard PS 1 issued by the U.S. Department of Commerce, and shall be grade marked by a recognized grading agency (APA and PTL).

H. Each piece of preservative treated lumber shall be identified by the Quality Mark of an approved inspection agency in accordance with Title 24, see Section 01 45 29: Testing and Inspection.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Lumber: Structural and framing lumber shall be of the following species and grades unless noted otherwise on the drawings:

	USE	SPECIES	GRADE
1.	Subfloor, wall sheathing, roof sheathing and ceiling stripping.	Douglas Fir	"Construction" Board, Structural #1 only WCLIB; WWPA
2.	Beams, girders and truss members (5" and thicker, rectangular, width more than 2" greater than thickness) where exposed as finish members.	Douglas Fir WWPA	Select Structural
3.	Joists, rafters, lintels, posts, mullions and members (2” to 4” thick, 2” to 4” wide)	Douglas Fir	“Structural No. 1 Structural Light Framing, WCLIB;
4.	Other lumber (2" to 4" thick, 2" to 4" wide) not specified in subparagraph 5 above.	Douglas Fir	"Structural No. 1" and Framing WCLIB; WWPA
5.	Framing lumber (2" to 4" thick, 5" and wider).	Douglas Fir	"No. 1" and better Joists and Planks, WCLIB; WWPA.
6.	Mudsills and plates in contact with soil.	Douglas Fir treated	Same as subparagraphs 5 and 6.
7.	Sills or plates resting on concrete or masonry surfaces 6" or less above soil or finish grade.	Douglas Fir treated	Same as subparagraphs 5 and 6.
8.	Sills, foundations plates & sleepers which rest on concrete, masonry foundations, or are laid on concrete on concrete slab in direct contact with soil.	Douglas Fir treated	Same as subparagraphs 4 and 5.
9.	Miscellaneous nailing strips and blocks embedded in concrete or masonry.	Douglas Fir treated	Same as subparagraphs 4 and 5.

B. Plywood: Plywood used for structural purposes, shall be APA grade Structural I plywood. Plywood used for non-structural exterior purposes shall be exterior type, or Exposure 1. Plywood used for non-structural interior purposes shall be 3/8” AC plywood.

C. Preservative Treated Wood:

1. Wood and plywood specified as treated wood shall be pressure treated wood in accordance with CBC 2303.1.8."

2. Seasoning: Treated lumber shall be air seasoned after treatment, for a minimum of 2 weeks before use.

3. Creosote shall not be used for treating wood in contact with painted or plastered surfaces.

4. When treated wood member has been notched, dapped, drilled or in any way cut into, such newly cut surfaces shall be painted with a heavy coat of same preservative material used in treatment of wood member.

D. Fire Retardant Protection: Wood and plywood specified as "Fire Retardant Protected Wood" shall be treated by approved methods and materials, and shall be dried, following treatment, to a maximum moisture content as follows: Solid sawn lumber 2" in thickness or less to 19%; and plywood to 15%.

E. Mineral Fiber Panels: Shall be asbestos free, thickness as indicated.

F. Reused Materials: Sound lumber and timber which has been used for formwork may not be reused for stress carrying or non-stress carrying members. May not be used in any construction other than formwork.

PART 3 – EXECUTION

3.1 FASTENINGS

A. Nails and Spikes:

1. Use only common wire nails or spikes.

2. Whenever necessary to prevent splitting, holes shall be prebored for nails and spikes.

3. Nails in plywood shall not be overdriven.

4. Machine Applied Nailing: Use of machine nailing is subject to a satisfactory jobsite demonstration for each project and approval by the Project Architect or Structural Engineer and the Division of the State Architect Field Representative. Approval is subject to continued satisfactory performance. Machine nailing will not be approved in 5/16" plywood. If nailheads penetrate outerply more than would be normal for a hand hammer or if minimum allowable edge distances are not maintained, performance will be deemed unsatisfactory and material may be scrapped.

B. Lag Screws:

1. When placing lag screws in a wood member, prebore lead hole as recommended in CBC Title 24 Sec 23.

2. Lag screws which bear on wood shall be fitted with standard steel plate washers under head. Lag screws shall be screwed and not driven into place.

3. Lag screws applied in moisture rich environments or “wet” timber shall be galvanized to prevent degradation of both the lag screw and the material.

C. Bolts:

1. Lumber and timber to be fastened together with bolts shall be clamped together and holes for bolts bored true to line.

2. Bolts shall be fitted with steel plates or standard cut washers under heads and nuts. Bolts shall be tightened when installed and again just before completion of work.

3. Bolts applied in moisture rich environments or “wet” timber shall be galvanized to prevent degradation of both the bolt and the material.

D. Wood Screws: When placing wood screws, lead holes shall be prebored as recommended in CBC Title 24. Wood screws shall be appropriately selected for the application and treated as necessary to prevent corrosion

E. Framing Anchors: Framing anchors, joist hangers, ties and other mechanical fastenings shall be galvanized or have a rust-inhibitive coating. Nails and fastenings shall be of type recommended by manufacturer.

3.2 ERECTION

A. Stud Walls, Partitions and Furring:

1. Wood stud walls, partitions and vertical furring shall be constructed of members of size and spacing indicated. Provide single plate at bottom and double plate at top unless otherwise indicated. Interior, nonbearing non-shear partitions may be capped with a single top plate, installed to provide overlapping at corners and at intersections with other wall and partitions or by metal ties as detailed.

2. Walls and partitions shall have horizontal staggered blocking not less than 2" nominal thickness and same width as studs, fitted snugly, and nailed into studs. Blocking shall be at mid-height of partition or not more than 7'-0" on center vertically. Install wood backing on top of top plate wherever necessary for nailing of lath or gypsum board.

3. Walls, partitions and furred spaces shall have 2" nominal thickness wood firestops, same width as space to be firestopped, at ceiling line, mid-height of partition and at floor line. Firestops at floor line are not required when floor is concrete. If width of opening is such that more than one piece of lumber is necessary, provide 2 thicknesses of 1" nominal material laid with staggered joints.

4. Firestops shall be placed in all stud walls and partitions, including furred spaces, so that maximum dimension of any concealed space is not over 10'-0".

5. Corners, and where wood stud walls and wood vertical furring meet, shall be formed of triple studs. Openings in stud walls and partitions shall have headers as indicated and a minimum of 2 studs at jambs, one stud of which may be cut to support header in bearing.

6. Where wood masonry or concrete walls intersect, end stud shall be fastened at top, bottom and midheight with one 1/2" diameter bolt through stud and embedded in masonry or concrete a minimum of 4". Bolts shall have washers under nuts.

7. Sills under bearing, exterior or shear walls shall be bolted to concrete with 5/8" rd. by 12" long bolts spaced not more than 4'-0" on center. There shall be a bolt within 9" of each end of each piece of sill. Sills shall be placed and leveled with shims and washers placed and nuts tightened to level bearing after which space between sill and concrete shall be dry packed with cement grout. Non-bearing interior plates may be fastened to concrete with low velocity powder driven fasteners provided Structural Engineer's approval is obtained in writing, prior to use.

B. Furring: Where metal furring is not indicated or specified, provide wood furring at all points indicated and required for concealing conduit, piping, structural framing or other unfinished materials. Wood furring shall be 2x studs of required width. Vertical members contacting concrete or masonry shall be attached as specified for anchoring interior wood stud partitions.

C. Nailing Strips and Plates:

1. Provide wood nailing strips, plates and blocking indicated or required. Nailing strips in connection with metal work shall be bolted to metal. Wood nailing blocks for securing grounds shall be built into concrete, or masonry.

2. Nailing schedule shall comply to Title 24, see Section 01 45 29: Testing and Laboratory Services.

D. Wood Backing: Provide wood backing as indicated and as required to receive plumbing, electrical fixtures and equipment, cabinets, door stop plates and other fixed equipment.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Firestopping for the following.

1. Penetrations through fire-resistance-rated ceiling/ roof construction including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

2. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.

3. Sealant joints in fire-resistance-rated construction.

B. Related sections:

1. All other sealants.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Provide firestopping systems produced and installed to resist the spread of fire and the passage of smoke and other gases in compliance with Code.

1. F-rated through-penetration firestop systems: Provide through-penetration firestop systems with F rating, determined in compliance with ASTM E 814, but not less than that equaling or exceeding the fire-resistance rating of the constructions penetrated.

2. T-rated through-penetration firestop systems: Provide through-penetration firestop systems with T rating, in addition to F rating, determined in compliance with ASTM E 814, where systems protect penetrating items exposed to contact with adjacent materials in occupiable floor areas. T-rated assembles are required where the following conditions exist.

a. Where firestop systems protect penetrations located outside of wall cavities.

b. Where firestop systems protect penetrations located outside fire-resistive shaft enclosures.

c. Where firestop systems protect penetrations located in construction containing doors required to have a temperature-rise rating.

d. Where firestop systems protect penetrating items larger than a 4 in. diameter nominal pipe or 15 sq. in. in overall cross-sectional area.

B. Fire-resistive joint sealants: Provide joint sealants with fire-resistance rating determined in compliance with ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

C. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that will not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing systems, provide moisture-resistant through-penetration firestop systems.

2. For penetrations with insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For firestopping exposed to view, provide products with flame-spread values of less than 25 and smoke-developed values of less than 450, as determined in compliance with ASTM E 84.

1.3 DEFINITIONS AND REFERENCE STANDARDS

A. ASTM E 84, Test Method for Surface Burning Characteristics of Building Materials.

B. ASTM E 119, Standard Method of Fire Tests of Building Construction and Materials.

C. ASTM E 814, Fire Tests of Through-Penetration Fire Stops.

D. UL 1479, Fire Tests of Through-Penetration Firestops.

E. UL Building Materials Directory: Through-Penetration Firestops Systems (XHEZ), and Fill, Void, or Cavity Materials (XHHW).

1.4 SUBMITTALS

A. Procedure: In accordance with Section 01 33 00.

B. Data: Manufacturer's product data for all materials and prefabricated devices and manufacturer's installation instructions.

C. Certification: Letter of certification, or certified laboratory test report that the material or combination of materials proposed for use meets the requirements specified in ASTM E 814, are so classified in UL Building Materials Directory, and are acceptable to DSA and comply with Title 24.

D. Certificates: Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.

E. Reports: Product test reports from, and based on tests performed by a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer's qualifications: Firm with at least 2 years experience with systems proposed for use, who has successfully completed firestopping installations similar in material, design, and extent to that indicated for Project on at least 5 comparable projects.

1. Where firestopping manufacturer selected has training/ certification program installer shall be certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff and training to install manufacturer's products as specified.

B. Single-source responsibility: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.

C. Certifications and Code approvals: Materials proposed for use shall be approved by DSA and Title 24 CAC for their intended use.

D. Compatibility: Provide firestop systems that are compatible with one another and with substrates under conditions of application and service, as demonstrated by manufacturer, based on testing and field experience.

1.6 PRODUCT HANDLING

A. Store and handle materials to prevent their deterioration or damage. Do not use damaged and contaminated materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. One or a combination of the following, depending on the condition of use:

1. 3M Fire Protection Products.

2. Bio Fireshield, Inc.

3. Hevi-Duty/Nelson.

4. Tremco, Inc.

5. Specified Technologies, Inc.

6. United States Gypsum Co. (USG).

2.2 MATERIALS

A. Accessories:

1. Provide components for each firestopping system that are needed to install fill materials and to comply with Article 1.02 above.

2. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

3. Accessories include but are not limited to the following items:

a. Permanent forming/damming/backing materials including the following:

1) Semi-refractory fiber (mineral wool) insulation.

2) Ceramic fiber.

3) Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.

4) Fire-rated formboard.

5) Joint fillers for joint sealants.

b. Temporary forming materials:

1) Substrate primers.

2) Collars.

3) Steel sleeves.

B. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

2.3 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

A. Ceramic-fiber and mastic coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.

B. Ceramic-fiber sealant: Single-component formulation of ceramic fibers and inorganic binders.

C. Endothermic, latex compound sealant: Single-component, endothermic, latex formulation.

D. Intumescent, latex sealant: Single-component, intumescent, latex formulation.

E. Intumescent putty: Non-hardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

F. Intumescent wrap strips: Single-component, elastomeric sheet with aluminum foil on one side.

G. Job-mixed vinyl compound: Pre-packaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

H. Mortar: Pre-packaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogenous mortar.

I. Silicone foam: 2-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, non-shrinking foam.

J. Silicone sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant.

K. Solvent-release-curing intumescent sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant.

L. Color: Where firestopping material is exposed to view in the work, provide material color selected by the Architect from the manufacturer's palette, unless material will be field-painted.

2.4 MIXING

A. For products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean surfaces to be in contact with firestopping materials of dirt, grease, oil, loose materials, rust, and other substances that may affect proper fitting or the required fire-resistance.

B. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.2 INSTALLATION

A. General: Install materials in compliance with their manufacturer's instructions and comply with printed instructions of UL Fire Resistance Directory.

B. Surface cleaning: Clean-out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements.

1. Remove foreign materials form surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.

2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form release agents from concrete.

C. Priming: Prime substrates where recommended by firestopping manufacturer using manufacturer's recommended products and methods. Confine primers to areas of bond. Do not allow spillage and migration on exposed surfaces.

D. Masking tape:

1. Use masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials.

2. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

A. Forming/damming materials and accessories:

1. Install as required to support fill materials during their application in position

needed to produce the cross-sectional shapes and depths required to achieve fire ratings of firestop systems.

2. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

B. Install fill materials for through-penetration firestop system to produce the following results:

1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces, flush with adjoining finishes.

3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

A. Install joint fillers to provide support of sealants during application and to produce the cross sectional shapes and depths of installed sealants that allow optimum sealant movement capability and develop fire-resistance rating required.

B. Install sealants so that they will directly contact and fully wet joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width. Install sealants at the same time joint fillers are installed.

C. Tool non-sag sealants immediately after sealant application and before skinning or curing begins. Form smooth, uniform beads. Eliminate air pockets, and ensure contact and adhesion of sealants with sides of joint.

1. Remove excess sealant from surfaces adjacent to joint.

2. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

3.5 FIELD QUALITY CONTROL

A. Examine firestopped areas to ensure proper installation prior to concealing or enclosing firestopped areas.

B. Repair damaged areas and restore the integrity of the assembly.

C. Keep areas of work accessible until inspection and approval by applicable code authorities.

3.6 CLEANING

A. Clean-up spills of liquid components.

B. Cut and trim excess materials neatly, flush with adjacent surfaces.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Latex joint sealants.
4. Preformed joint sealants.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers eight samples of materials that will contact or affect joint sealants. Use ASTM C 1087 or manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates. Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product test reports.

E. Preconstruction compatibility and adhesion test reports.

F. Preconstruction field-adhesion test reports.

G. Field-adhesion test reports.

H. Warranties.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

B. Preinstallation Conference: Conduct conference at Project site.

1.5 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.

2. Sealant Primers for Nonporous Substrates: 250 g/L.

3. Sealant Primers for Porous Substrates: 775 g/L.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

2.2 SILICONE JOINT SEALANTS

A. Neutral-Curing Silicone Joint Sealant : ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Building Systems.

b. Dow Corning Corporation.

c. GE Advanced Materials - Silicones.

d. Pecora Corporation.

e. Polymeric Systems, Inc.

f. Schnee-Morehead, Inc.

g. Sika Corporation; Construction Products Division.

h. Tremco Incorporated.

2. Type: Single component (S) or multicomponent (M).

3. Grade: Pourable (P) or nonsag (NS).

4. Class: 100/50.

5. Uses Related to Exposure: Traffic (T).

2.3 LATEX JOINT SEALANTS

A. Latex Joint Sealant [LS-<#>]: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Building Systems.

b. Bostik, Inc.

c. Pecora Corporation.

d. Schnee-Morehead, Inc.

e. Tremco Incorporated.

2.4 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.5 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove laitance and form-release agents from concrete.

2. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.

3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations.

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.3 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

a. Perform 5 tests for the first 500 feet (300 m)] of joint length for each kind of sealant and joint substrate.
b. Perform 1 test for each 1000 feet (300 m) of joint length thereafter.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.4 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.

b. Tile control and expansion joints.

c. Joints between different materials listed above.

d. Other joints as indicated.

2. Joint Sealant: Silicone.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.

b. Control and expansion joints in unit masonry.

c. Joints between different materials listed above.

d. Perimeter joints between materials listed above and frames of doors, windows and louvers.

e. Control and expansion joints in ceilings and other overhead surfaces.

f. Other joints as indicated.

2. Joint Sealant: Silicone.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.

b. Control and expansion joints in tile flooring.

c. Other joints as indicated.

2. Joint Sealant: Silicone.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

D. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.

b. Perimeter joints of exterior openings where indicated.

c. Tile control and expansion joints.

d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls and partitions.

e. Perimeter joints between interior wall surfaces and frames of interior doors windows and elevator entrances.

f. Other joints as indicated.

2. Joint Sealant: Latex.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.

b. Tile control and expansion joints where indicated.

c. Other joints as indicated.

2. Joint Sealant: Silicone.

3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes access doors and frames for walls and ceilings.

1.2 SUBMITTALS

A. Product Data: For each type of access door and frame indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each door face material in specified finish.

D. Schedule: Types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.3 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252for vertical access doors and frames.

2. ASTM E 119 for horizontal access doors and frames.

1.4 COORDINATION

A. If retaining this Article, also retain "Schedule" Paragraph in "Submittals" Article.

B. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 STEEL MATERIALS

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

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

1. ASTM A 123/A 123M, for galvanizing steel and iron products.

2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

C. Steel Sheet: **electrolytic zinc-coated, ASTM A 591/A 591M with** cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS) with A60 (ZF180) zinc-iron-alloy (galvannealed) coating or G60 (Z180) mill-phosphatized zinc coating.

E. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Factory-Primed Finish: Manufacturer's standard shop primer.

2. Baked-Enamel Finish: Minimum dry film thickness of 2 mils (0.05 mm).

3. Powder-Coat Finish: Thickness not less than 1.5 mils (0.04 mm).

F. Drywall Beads: 0.0299-inch (0.76-mm) zinc-coated steel sheet to receive joint compound.

G. Plaster Beads: 0.0299-inch (0.76-mm) zinc-coated steel sheet with flange of expanded metal lath.

H. Manufacturer's standard finish.

2.2 ALUMINUM MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6, mill finish.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6, mill finish.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M).

1. Mill finish.

2. Anodic Finish: **Class II, clear anodic coating complying with AAMA 611 Class I, clear anodic coating complying with AAMA 61**].

3. Baked-Enamel Finish: Manufacturer's standard.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. Bar-Co, Inc. Div.; Alfab, Inc.
4. Cendrex Inc.
5. Dur-Red Products.
6. Elmdor/Stoneman; Div. of Acorn Engineering Co.
7. Jensen Industries.
8. J. L. Industries, Inc.
9. Karp Associates, Inc.
10. Larsen's Manufacturing Company.
11. MIFAB, Inc.
12. Milcor Inc.
13. Nystrom, Inc.
14. Williams Bros. Corporation of America (The).

C. Flush Access Doors and Trimless Frames: Fabricated from **steel** sheet.

1. Locations: **Wall and ceiling** surfaces.
2. Door: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal.
3. Frame: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal with **drywall** /**plaster** bead flange.
4. Hinges: **Continuous piano**.
5. Latch: **Cam latch**with interior release.
6. Lock: **Mortise cylinder**.

D. Fire-Rated, Insulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from **steel** sheet.

1. Locations: **Wall and ceiling** surfaces.
2. Fire-Resistance Rating: Not less than **that of adjacent construction** .
3. Temperature Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
4. Door: Flush panel with a core of mineral-fiber insulation enclosed in sheet metal with a minimum thickness of **0.036 inch (0.9 mm)**.

5. Frame: Minimum **0.060-inch- (1.5-mm-)** thick sheet metal with **1-inch- (25-mm-)** wide, surface-mounted trim.

6. Hinges: **Continuous piano**.

7. Automatic Closer: Spring type.

8. Latch: Self-latching device operated by **flush key** with interior release.

9. Lock: Self-latching device with **mortise cylinder** lock.

   a. Lock Preparation: Division 08 Section "**Door Hardware**."

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view, provide materials with smooth, flat surfaces without blemishes.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

F. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 09 90 00
PAINTING

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. This section covers painting of exposed elements of the project, interior and exterior, Sealing and back priming of wood in the field. Surfaces that are left unfinished by requirements of other sections shall be finished as part of this section.

1.2 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.

1.3 RELATED SECTIONS:

A. Section 05 50 00- Metal Fabrications.

B. Section 06 20 00 - Finish Carpentry.

C. Section 07 62 00 –Sheet Metal Flashing and Trim

D. Section 08 11 13 – Hollow Metal Doors and Frames and Window Frames.

E. Section 08 14 16 – Flush Wood Doors.

F. Section 09 24 00 – Portland Cement Plaster.

H. Section 09 29 00– Gypsum Board.

1.4 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.

1.5 SUBMITTALS

A. Submittals shall be made in accordance with Section 01 33 00.

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 (16” long) on same species and quality of wood to be installed on the project, showing system used and each step of the finishing process>.

E. Manufacturers shall verify that their products conform to latest California Air Resources Board and AQMD regulations.

F. An MSDS sheet will be included with each individual submittal.

1.6 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.

1.7 ENVIRONMENTAL CONDITIONS

A. General: Follow mfr.'s printed recommendations for product when they are more stringent than limits stated herein.

B. Do not apply "paint" to "wet-applied" construction until such work is "dry", and acceptable to Construction Manager and "paint" mfr.

C. Temperature and Humidity: Do not apply exterior paint in damp, rainy or foggy weather (above 90% relative humidity) 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 100 degrees F., or dust conditions are unfavorable to proper workmanship.

D. Ventilation: As necessary to provide air movement, aid drying, disperse noxious fumes.

1.8 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

2.1 PAINT MATERIALS

A. General: All materials used in the work are listed for Dunn-Edwards Paint.

B. Regulatory changes may affect the formulation, availability, or use of specified coatings. Verify with supplier or your representative regarding such changes prior to start of painting project.

C. 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. Dunn-Edwards products are specified herein except as otherwise noted, to establish types and qualities.

PART 3 – EXECUTION

3.1 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 Inspector 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.P.S. 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.P.S. 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.P.S. 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.

3.2 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, 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. FASO will be sent 48 hour notices for paint completion inspection.

G. Do not "paint-out" underwriters' labels, fusible links, sliding surfaces and identification stamps.

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.

3.3 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 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.

E. Collect waste material, which may constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.4 EXTERIOR PAINT SCHEDULE

A. Metal Work; Exterior:

1. Galvanized Metal; Exterior:

a. Preparation: Before application, properly clean and etch (solvent wash) galvanized surfaces in accordance with preparation instructions for galvanized metal per Articles 3.02 H and 3.04F herein.
b. Coat 1: Rust Preventative Metal Primer Bloc-Rust Premium Primer (BRPR00-1)
c. Coat 2: 100% Acrylic Semi-Gloss Enamel EVERSHIELD (EVSH50), 100% Acrylic Gloss Enamel EVERSHIELD (EVSH60)

d. Coat 3: EVERSHIELD 100% Acrylic Semi-Gloss Enamel (EVSH50) EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
e. DFT: 6 mils.

2. Ungalvanized Steel;Apply first prime coat immediately after steel is cleaned.

a. Coat 1: Rust Inhibitive Primer CORROBAR, White Alkyd Corr. Inhibitive Primer (43-5) Bloc-Rust Premium Primer (BRPR00-1)
b. Coat 2: Rust Inhibitive Primer Not Necessary
c. DFT for Coats 1 & 2 3.5 mils. Bloc-Rust Premium Primer (BRPR00-1)
d. Coat 3: 100% Acrylic Enamel Sash EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
Or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
e. Coat 4: 100% Acrylic Enamel Sash EVERSHIELD,100% Acrylic Semi-Gloss Enamel (EVSH500
Or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
f. DFT for coats 3 & 4: 4 mils.

3. Ungalvanized Steel: Concealed: Apply prime coat immediately after steel is cleaned.
a. Scope: Apply to all structural steel surfaces hidden and enclosed, within the building envelope (not exposed to view), except members with flanges ¼" or thicker and webs 3/16" or thicker need NOT to be painted.
b. Prime Coat: Rust Inhibitive Primer Bloc-Rust Premium Primer (BRPR00-1)

c. DFT: 2 mils.

4. All Shop Primed Metals; Exterior:

a. Preparation: Touch up damaged, scratched, or missing prime coat paint using top-quality rust-inhibitive primer recommended by paint mfr. lightly sand smooth, ready to receive finish coats.
b. Coat 1: 100% Acrylic Enamel Bloc-Rust Premium Primer -Rust-Preventative Acrylic Primer (BRPR00-1)
c. Coat 2: 100% Acrylic Enamel-EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
d. DFT: 4 mils.

5. Factory Finished Equipment & Items:

a. Coat 1: Acrylic Enamel Sash & Trim EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
b. DFT: 2 mils.

6. Aluminum; Where Indicated To Be Painted Or Where Previously Painted:

a. Follow paint mfr's. recommendations, and specifications.
b. Prepare surface by phosphatizing and cleaning same as for Galvanized Surfaces, Articles 3.02H and 3.04F.
c. Coat 1: Oil-Cementious Primer GALV-ALUM, Galv./Alum. Metal Primer GAPROO
d. Coat 2: 100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
e. Coat 3:100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH60)
or EVERSHIELD, 100% Acrylic Gloss Enamel (W 960V) (EVSH60)
f. DFT: 5 mils.

B. Exterior Work: Other Than Metals: Existing and At Repairs or New to Match Existing; Match Existing Finishes/Paint:

1. Wood (Painted):

a. Coat 1: Exterior Wood Primer E-Z Premium PRIME, Ext. 100% Acrylic Wood Primer (EZPR00-0)
b. Coat 2: 100% Acrylic Exterior Wood EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
c. Coat 3: 100% Acrylic Exterior Wood EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD,100% Acrylic Gloss Enamel (EVSH60)
d. DFT: 5 mils.

2. Wood (Stained/Natural Finish) Smooth or "Rough Surface" Materials, Trim, Boards, Fascia, Etc., Wood Trellis Siding, Trim, Boards, and Fascia:

a. Coat 1: Exterior Wood Stain OKON WeatherPro Tinted, (WPT-3)
Prime all surfaces of all new pieces completely before installation (faces, edges, ends). After installation, inspect members; touch-up any damage, cuts, and nail holes.
b. Coat 2: Exterior Wood Stain OKON WeatherPro Tinted, (WPT-3)
c. Application Rate: 150 sf./per gallon/per coat.

3. Cement Plaster:

a. Coat 1: Masonry Concrete Sealer EFF-STOP PERMIUM Masonry Primer/Sealer (ESPR00)
b. Coat 2: Exterior Masonry Finish SPARTASHIELD, Exterior 100% Acrylic Flat Finish (SSHL10)
or EVERSHIELD , 100% Acrylic Ext. Masonry Finish (EVSH10)
c. Coat 3: Exterior Masonry Finish SPARTASHIELD, Exterior 100% Acrylic Flat Finish (SSHL10)
or EVERSHIELD, 100% Acrylic Ext. Masonry Finish (EVHS10)
d. DFT: 4.0 mils.

4. Concrete; Columns, Wall Caps, Beams, Wall Exposed Foundation Walls & Curbs and Where Indicated:

a. Coat 1: Masonry/Concrete Sealer, on bare concrete and as required EFF-STOP PERMIUM, (W709) (ESPR00)
b. Coat 2: Exterior Masonry Finish EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
c. Coat 3: Exterior Masonry FinishEVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
d. DFT: 3.6 mils.

6. Plastic or Rubber Condensate Piping & Other Plastic Piping Exposed on Roof-Tops:

a. Coat 1: Multipurpose Primer ULTRA-GRIP PREMIUM, Multi-Purpose Latex Primer (W 715) (UGPR00)
b. Coat 2: 100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
c. Application Rate/DFT for finish coats: As required to cover completely one coat to cover.

3.5 INTERIOR PAINT SCHEDULE

A. Interior Work: Typically Match Existing Finishes/Paint:

1. Softwood; Typically, and Medium Density Overlaid (MDO) Doors; Existing and at Repairs or New To Match Existing:

a. Coat 1: ULTRA-GRIP PERMIUM, Multi-Purpose Latex Primer (UGRP00)
b. Coat 2: 100% Acrylic Semi-Gloss Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH60)
c. Coat 3: 100% Acrylic Semi-Gloss Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss (EVSH60)
d. DFT: 4 mils.

2. Interior Hardwood Doors, Paneling, Doors, Transom Panels, Trim, Handrails, Softwood Casework, Paneling & Casework & Similar; With Stained/Natural Finish/Transparent Finish and; where not factory finished, Plastic Laminate, or Painted:

a. Sealer: At contractors option and expense N/A
b. Coat 1: NOT NEEDED ZENITH IS SELF SEALING
c. Coat 2: Gloss Varnish ZENITH WB CONVERSION VARNISH (PKC7509)
d. Coat 3: Gloss Varnish ZENITH WB CONVERSION VARNISH (PKC7509)
e. Coat 4: Satin Varnish Defthane 2 ZENITH WB CONVERSION VARNISH (PKF7502)
f. DFT: 3.5 mils.
g. Lacquer Option: With specific approval or Architect Construction Manager & District, Lacquer may be used in lieu of varnish. CE-275PRO90
h. In existing buildings, match existing finishes unless noted otherwise.

3. “Rough Surface” Wood Trim; Existing and at Repairs or New to Match Existing:

a. Coat 1: Exterior Wood Stain OKON WeatherPro Tinted, (WPT-3)
b. After installation, inspect members; touch-up any damage, cuts and nail holes.
c. Coat 2: Exterior Wood Stain OKON WeatherPro Tinted, (WPT-3)
d. Application Rate: 150 sf/per gallon per coat.

4. “Smooth Surface” Plywood at Equipment Backboards:

a. Coat 1: Enamel Undercoater ULTRA-GRIP PREMIUM, Multi-Purpose Latex Primer (W 715) (UGPR00)
b. Coat 2: Stipple Enamel, Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
c. Coat 3: Enamel, Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
d. DFT: 5 mils.

5. Existing Painted Casework and or Painted Wall Paneling:

a. Coat 1: Enamel Undercoater INTER-KOTE PREMIUM, Int. 100% Acrylic Enamel Undercoater (IKPR00)
or ULTRA-GRIP PREMIUM, Multi-Purpose Latex Primer (UGPR00)

b. Coat 2: Enamel, Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
c. Coat 3: Enamel, Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
d. DFT: 6 mils.

6. Plaster Walls & Ceilings; Existing and at Repairs or New to Match Existing:

a. Coat 1: Latex Sealer, Pigmented EVERSHIELD, 100% Acrylic Ext. Masonry Finish EVSH10)
or ULTRA-GRIP PREMIUM, Multi-Purpose Latex Primer (UGPR00)
b. Coat 2: Enamel Undercoater
c. Coat 3: Typically match existing: One of the following as applicable or selected by Architect Construction Manager:

1) Enamel Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
Or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
2) Enamel, Low Sheen EVERSHIELD, 100% Acrylic Eggshell Low Sheen Enamel (EVSH40)
or SUPREMA, Int. 100% Acrylic Low Sheen Enamel 0(SPMA40)

(1) Stipple Enamel, Semi-Gloss. Apply with an Architect approved heavy-texture stipple roller. EVERSHIELD, (W901) or EVERSHIELD, (EVSH50)

d. DFT: 5mils.

7. Concrete, Concrete Block and Brick; Existing Painted and at Repairs or New To Match Existing:

a. Coat 1: Concrete Sealer EVERSHIELD, 100% Acrylic Ext. Masonry Finish (EVSH10)
b. Coat 2: Enamel Undercoater SUPREMA, Latex Low Gloss Enamel (SPMA20)
c. Coat 3: Match existing: Enamel, Semi-Gloss, Low Sheen, or Velvet or Stipple as selected by Architect Construction Manager. SUPREMA, (SPMA20) or SUPREMA, (SPMA40) or, SUPREMA (SPMA50)
d. DFT: 5 mils.

8. Drywall Walls: Typical:

a. Coat 1: Latex Sealer VINYLASTIC PREMIUM, Interior Pigmented Sealer (VNPR00)
b. Coat 2: Stipple Enamel or Flat Latex SUPREMA, Int. 100% Acrylic Semi-Gloss Enamel (SPMA50)
or EVERSHIELD, Int. 100% Acrylic Low Sheen Enamel (EVSH40)
c. Coat 3: Enamel Semi-Gloss or Low Sheen SUPREMA, Int. 100% Acrylic Semi-Gloss Enamel (SPMA50)
or SUPREMA, Int. 100% Acrylic Low Sheen Enamel (SPMA40)

(1) Enamel, Semi-Gloss EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
Or EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (SPMA50)
(2) Enamel, Low Sheen SUPREMA, Int. 100% Acrylic Low Sheen Enamel (W 440V) (SPMA40)
(3) Enamel Velvet SUPREMA, Latex Low Gloss Enamel (SPMA20)
(4) Flat Wall Latex SUPREMA, Interior Flat Wall Finish (W 401) (SPMA10)

d. DFT: 6mils.

9. Drywall Ceilings

a. Coat 1: Latex Sealer VINYLASTIC PREMIUM, Interior Pigmented Sealer (W 101V) (VNPR00)
b. Coat 2: Flat Wall Latex SUPREMA, Interior Velvet Flat Wall Finish (W 401) (SPMA10)
c. Coat 3: Flat Wall Latex SUPREMA, Interior Velvet Flat Wall Finish (W 401) (SPMA10)
d. DFT: 4 mils.

10. Drywall Walls & Ceilings At Toilets, Storage Rooms, and Electrical and Mechanical Rooms:

a. Coat 1: Latex Sealer VINYLASTIC PREMIUM, Interior Pigmented Sealer (VNPR00)
b. Coat 2: Enamel Undercoater EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
c. Coat 3: Stipple Enamel, Semi-Gloss EVERSHIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
d. DFT: 5 mils.

B. Metal Work; Interior:

1. Galvanized Metal;

a. Preparation: Before application, properly clean and etch (solvent wash) galvanized surfaces in accordance with preparation instructions for galvanized metal per Articles 3.02 H and 3.04F herein. (SCME-01)
b. Coat 1: Rust Preventative Metal Primer Bloc-Rust Premium Primer (BRPR00-1)
c. Coat 2: 100% Acrylic Enamel EVERSHIELD 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
d. Coat 3: 100% Acrylic Enamel Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
Or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
e. DFT: 6 mils.

2. Ungalvanized Steel Interior: Exposed: Apply prime coat immediately after steel is cleaned.

a. Coat 1: Rust Preventative Metal Primer Bloc-Rust Premium Primer (BRPR00-1)
b. Coat 2: 100% Acrylic Enamel EVERSHIELD 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
c. Coat 3: 100% Acrylic Enamel Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
Or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
a. DFT: 6 mils.

3. Ungalvanized Steel Interior: Concealed: Apply prime coat immediately after steel is cleaned.

a. Scope: Apply to all structural steel surfaces hidden and enclosed, within the building envelope (not exposed to view), except members with flanges ¼" or thicker and webs 3/16" or thicker need NOT to be painted.

b. Prime Coat: Rust Inhibitive Primer Bloc-Rust Premium Primer (BRPR00-1) DFT: 2 mils.

4. All Shop Primed Metals; Interior:

a. Preparation: Touch up damaged, scratched, or missing prime coat paint using top-quality rust-inhibitive primer recommended by paint mfr. lightly sand smooth, ready to receive finish coats.
b. Coat 1: Rust Preventative Metal Primer Bloc-Rust Premium Primer (BRPR00-1)
c. Coat 2: 100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD 100% Acrylic Gloss Enamel (EVSH60)
d. DFT: 4 mils.

5. All Shop Primed Metals; Interior:

a. Preparation: Touch-up damaged, scratched, or missing prime coat paint using top-quality rust-Inhibitive primer recommended by paint mfr. Lightly sand smooth, ready to receive finish coats.
b. Coat 1:Sash and Trim Rust Preventative Metal Primer Bloc-Rust Premium Primer (BRPR00-1)
c. Coat 2: Sash and Trim Industrial Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
d. DFT: 4 mils.

6. Factory Finished Equipment & Items:

a. Coat 1:Acrylic Enamel Sash & Trim EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
b. DFT: 2 mils.

7. Aluminum; Where Indicated To Be Painted Or Where Previously Painted:

a. Follow paint mfr's. recommendations and specifications.
b. Prepare surface by phosphatizing and cleaning same as for Galvanized Surfaces, Articles 3.02H and 3.04F.
c. Coat 1: Oil-Cementious Primer GALV-ALUM PREMIUM, Galv./Alum. Metal Primer (GAPR00)
d. Coat 2: 100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
e. Coat 3: 100% Acrylic Enamel EVERSHIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
or EVERSHIELD, 100% Acrylic Gloss Enamel (EVSH60)
f. DFT: 5 mils.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section provides the basic plumbing requirements that apply to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing

3. Division 23: HVAC

4. Division 26: Electrical.

1.2 REGULATORY REQUIREMENTS

A. Current federal Safe Drinking Water Act (SDWA) regulations require the furnishing of lead-free pipe, solder, and flux in the installation or repair of plumbing in non-residential facilities connected to public drinking water systems. Under this regulation, solders and flux are considered lead-free when they contain 0.2 percent lead or less. Under California regulations pipes and pipe fittings are considered lead-free when they contain 0.25 percent lead or less as defined in California Assembly Bill 1953 (AB 1953). No pipe, pipe fittings, or any other fitting or fixture intended to convey or dispense water for human consumption by drinking or cooking is allowed in the domestic plumbing system, if they do not meet the low lead definition of AB 1953. Weighted average lead content of the wetted surface area of pipes, fittings and fixtures may not exceed 0.25 percent.

1. Provide lead-free water pipe, solder, and flux materials that meet the standards as outlined by the federal SDWA regulations and California AB 1953 if installed in drinking water system.

2. Collect pipe, solder, and flux material samples as required by the Project Inspector. Test samples shall be delivered to an Owner designated testing laboratory for testing of lead content.

a. Test samples for lead content by the atomic absorption spectrophotometry method.

3. Materials found not conforming to SDWA and California AB 1953 regulations shall be deemed defective Work and shall be replaced with lead-free materials.

4. Comprehensive testing of the remaining materials for their lead content shall be performed as required by the Project INSPECTOR.

A. Materials, fabrication, equipment, and installation shall comply with industry standards and code requirements. Where manufacturer's recommendations exceed industry standards, the

manufacturer's recommendation shall establish the minimum standard. As a minimum, standards from the following organizations shall apply:

1. ANSI - American National Standards Institute.

2. ASME - American Society of Mechanical Engineers.

   a. ASME Boiler and Pressure Vessel Code.

   b. ASME B31 - Standards for Pressure Piping.

3. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers.

4. ASTM - American Society for Testing and Materials.

   a. ASTM A53 Specification for Welded and Seamless Pipe.

5. AWWA - American Water Works Association.

6. CSA - Canadian Standards Association.

7. FM Global - Factory Mutual Global

8. IAPMO - International Association of Plumbing and Mechanical Officials.

9. NFPA - National Fire Protection Association.

10. OSHA - Occupational Safety and Health Administration.

11. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association.

12. UL - Underwriters Laboratories Inc.

13. Intertek (ETL Certification).

B. Materials, fabrication, equipment, and installation shall comply with federal, state, and local codes including, but not limited to, the following:

   1. CBC, California Building Code, and CMC, California Plumbing Code.

      a. Latest edition as adopted by the City of Ventura, the County of Ventura, and the State of California including amendments effective on the Effective Date of the Contract.

   2. California Code of Regulations, Title 8, Industrial Relations, Division 1, Chapter 4, Division of Industrial Safety.

   3. OSHA - Occupational Safety and Health Administration.

   4. CDPH - California Department of Public Health.

   5. SCAQMD - South Coast Air Quality Management District.

C. Specifications or Drawings shall not be construed to permit deviation from the requirements of governing codes unless approval has been obtained from legally constituted authorities having

jurisdiction, and the Architect. The Contract Documents may contain more stringent requirements than those legally required.

D. Permits and Fees: Refer to the General and Supplementary Conditions.

1.3 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00: Submittal Procedures and with specific requirements of Division 22 sections, as applicable.

B. The above information shall become the basis for inspecting and testing materials and actual installation procedures performed in the Work.

C. Shop Drawings: Submit one additional copy when control diagrams having line voltage connections are indicated. Shop Drawings shall be specifically prepared for the Work of this Project. Drawings prepared in accordance with requirements of Section 01 31 13: Project Coordination and Section 01 33 00 may be provided by the Architect to serve as a background for the Shop Drawings. Shop Drawings shall comply with the requirements of Section 01 31 13 and Section 01 33 00 and shall indicate at a minimum:

1. Complete system layout of equipment, components, plumbing fixtures, piping, indicating service clearances, and pipe sizes, fitting types and sizes and pipe elevations, distances of pipes and equipment from building reference points and hanger support locations. The above items shall be coordinated on the shop drawings according to the requirements of Section 01 31 13.

2. Schedule and description of equipment, piping and fittings.

1.4 PROJECT RECORD DOCUMENTS

A. Comply with provisions of Section 01 77 00: Contract Closeout.

B. Project Record Drawings:

1. Provide a complete set of plumbing and fire protection drawings in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks and plotter pen color/line thickness settings on CD-ROM. Also submit one set of full size reproducible plots on vellum and 3 sets of prints.

2. Before Contract Completion, deliver corrected and completed prints to the OAR. Delivery of project record documents to the OAR does not relinquish responsibility of furnishing required information omitted from project record documents.

C. Operation and Maintenance Manuals:

1. Submit two copies of operation and maintenance manuals in required form and content. If no revisions are required, furnish one additional copy. If revisions are required, one copy shall be returned with instructions for changes; perform such changes and return three copies of manuals. Manuals shall be bound in accordance to Section 01 77 00. Deliver manuals to the OAR. Submit an electronic copy of the entire manual in PDF file format.

2. Contents of Manual:

a. Title sheet with Project name, including names, addresses and telephone number of Contractor, installer, and related equipment suppliers.

b. Manufacturer's operating instructions including, but not limited to, the following:

1) Identification of components and controls.

2) Trouble shooting checklist and guidelines.

3) Recommendations for optimum performance.

4) Warnings and safety precautions on improper or hazardous operational procedures or conditions

c. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 22 that includes the following as a minimum:

1) Manufacturer’s model, identification and serial numbers.

2) Exploded view of assembly drawings identifying each component or part with the relevant part number.

3) Directory of manufacturer’s representatives, service contractors and part distributors.

4) Maintenance and trouble-shooting instructions, including schedule for preventive maintenance, periodic inspection and cleaning criteria.

d. Project Record Drawings: Complete set of plumbing, fire protection and control system drawings in 50 percent reduced print format shall be furnished with the manual. Submit the above record drawings on CD-ROM in AutoCAD and, if available, BIM, complete with external reference drawings, fonts, blocks, and plotter pen color/line thickness settings.

e. Testing, Adjusting, and Balancing reports: Submit as specified in Section 23 05 93.

f. South Coast Air Quality Management District (SCAQMD) permits to install and operate boilers, water heaters and other fuel burning equipment and third-party source test reports as required by SCAQMD to allow start-up and operation of equipment.

g. Ventura County industrial waste permits.

h. Valve directory complete with location, function, size, and model of each valve with reference to the project record drawings.

i. Equipment and component identification chart complete with location, function, size, and model of each equipment or component with reference to the project record drawings.

1.5 COORDINATION

A. Contract Documents indicate extent and general arrangement of Work under Division 22. Contractor shall coordinate work in accordance with Section 01 31 13 requirements and make adjustments as required to provide maximum headroom, a neat arrangement to keep passageways and openings clear to provide accessibility and provisions for maintenance, and to meet code requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Deliver materials to Project site in their original unopened containers with labels intact and legible at time of delivery. Store in strict accordance with manufacturer's recommendations.

B. Do not store plastic pipe or materials in direct sunlight.

1.7 PRELIMINARY OPERATION

A. OAR may require any portion of plumbing Work to be operated before Substantial Completion. Such operation shall be in addition to regular tests, demonstrations and instructions required under the Contract Documents, and shall be performed as required.

B. Notify the INSPECTOR at least 24 hours in advance of lighting or re-lighting pilots.

1.8 TRAINING OF OWNER PERSONNEL

A. Training of Owner's personnel shall include:

1. A minimum of 4 hours of on-site overview of the overall Plumbing System.

2. Refer to Division 22 sections for specific training on each of the components of the Plumbing System.

B. Contract shall include the cost of training Owner operation and maintenance personnel in operating, adjusting, maintenance, trouble-shooting, and Project site repair of each component, equipment, or system provided under this Contract.

C. Operational and maintenance training shall be conducted on the Project site, unless indicated otherwise.

D. Upon completion of Owner training, a completion certificate indicating the nature of the training and a description of the systems, complete with equipment and component lists shall be issued to each trainee. The certificate should be issued in duplicate with one copy retained by OAR.

E. An attendance sheet with the names and signatures of all participants attending the training shall be submitted to the OAR and kept as part of the project documents.

1.9 GUARANTEES AND DAMAGE RESPONSIBILITY

A. Sound of water flowing in piping shall not be transmitted to building structure. Operation of mechanical system shall not produce operational sounds that can be heard outside of rooms enclosing apparatus or equipment.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Unless otherwise specified, materials and equipment shall be new, in good and clean condition. Equipment, materials, and components shall be of the make; type and model number noted on Drawings or specified. Pieces of equipment of the same type shall be by the same manufacturer.

B. Whenever an item is listed by a single proprietary name, with or without model number and type, it shall be for purpose of design only, to indicate characteristics and quality desired. Proprietary

designation listed on Drawings, or listed first in Specifications, is used as a basis for design to establish a standard for quality and performance and space requirements.

C. Equipment and materials indicated or required to be installed outdoors shall be of the type that is designed, manufactured, listed or approved by authorities having jurisdiction for outdoor installation by being resistant to the adverse effects of weather. The additional protective measures against outdoor weather required by the manufacturers' installation instructions and prevalent practice shall be provided.

D. For substitution of materials or products, refer to the General Conditions.

PART 3 – EXECUTION

3.1 SERVICE INTERRUPTIONS, OFF-SITE, GAS AND WATER

A. Schedule Work so there shall be no service interruptions of existing systems or systems during normal hours of operation of affected systems and facilities.

B. When service interruptions are mandatory, arrange in advance with the OAR as to time and date of such interruptions.

C. Systems, which are interrupted, shall be returned back into operation in such manner that they will function as originally intended.

3.2 CUTTING, NOTCHING, AND BACKING

A. Conform to California Building Code, Title 24, Part 2, for notches and bored holes in wood and for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on structural Drawings.

B. Where pipes pass through, or are located within one inch of any construction element, install a resilient pad, ½ inch thick minimum, to prevent contact.

C. Furnish provisions for recesses, chases, and accesses and provide blocking and backing for proper reception and installation of plumbing Work.

3.3 LOCATION OF PIPING AND EQUIPMENT

A. Location of piping, apparatus and equipment indicated on the Drawings is approximate and shall be altered to avoid obstructions, preserve headroom, and provide free and clear openings and passageways.

B. Trenches parallel to footings shall not be closer than 18 inches to the face of footings and shall not be below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footing.

C. Pipe in tunnels shall be installed close to one side of tunnel to provide maximum space for passage. Pipe shall not be installed through crawl hole unless otherwise specified or detailed on Drawings.

D. Place equipment in locations and spaces indicated, disassemble and/or reassemble equipment as required by Project conditions.

3.4 TESTS AND TESTING

A. Tests shall be as required under the applicable sections of Division 22, including this Section.

B. Additional tests may be required in the case of products, materials, and equipment if:

1. Submitted items are altered, changed, or cannot be determined as exactly conforming to the Contract Documents.

2. Performance testing and results may also be required on certain items which are as specified, including fan, and pump performance.

C. Piping Tests:

1. Perform tests required to demonstrate that operation of plumbing systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be performed in presence of the Inspector, and representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required results are provided.

2. If required tests are not performed, Owner may provide in accordance with the Contract Documents.

3. Pressure gauges furnished in testing shall comply with CPC. Air shall be bled from lines requiring hydrostatic or water tests.

4. Systems shall be pressure-tested in accordance with pipe testing schedule below. Pipe test shall indicate no loss in pressure after a minimum duration of 4 hours at test pressures indicated. Where local codes require higher test pressures than specified herein for fire sprinkler systems, local codes shall govern.

5. Fuel gas lines shall be first tested with piping exposed, before backfilling trenches or lathing; second with piping in finished arrangement, backfilled and paved where required, and walls finished.

6. Piping systems may be tested as a unit or in sections, but entire system shall successfully meet requirements specified herein, before final testing by the Inspector.

7. Repair of damage to pipes and their appurtenances or to any other structures resulting from or caused by these tests, shall be provided.

D. Pipe Testing Schedule:

System Tested	**Test Pressure (psig)**	**Test With:**
Durham system, glass or plastic acid waste, vent and roof drain (except pipes running under a slab or underground)	Fill with water to top of highest vent; allow to stand two hours, or longer, as required by Inspector. Minimum head required for any joint shall be 10 feet in building.	Water
Cast-iron soil, waste and interior downspout, condensate drain from air conditioning equipment	10 feet of water, vertically	
Storm water disposal lines	Running water test	Water
Vacuum pump or condensate pump discharge and condensate	150	Water

return piping		
Domestic water piping	200	Water
Standpipes, wet or dry	300	Water
Fire sprinkler piping	200	Water
Gas piping(steel threaded or plastic)	60 (both tests)	Air
Gas piping (steel welded)	100 (both tests)	Air
Gas welding station	1-1/2 Working pressure 100 min.	Dry nitrogen
Compressed air piping	175	Air

E. Equipment Performance Assurance Tests:

1. Before operating any equipment or systems, a thorough check shall be performed to determine that systems have been flushed and cleaned as required and that equipment has been properly installed, aligned, lubricated, and serviced. Factory instructions shall be checked to verify installations have been completed and recommended lubricants have been installed in bearings, gearboxes, crankcases, and similar equipment. Particular care shall be furnished in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for damage that may have occurred during shipment, after delivery, or during installation. Damaged equipment, products, and materials shall be replaced or repaired as required.

2. Upon completion of the above, adjust the system settings to within normal operating conditions to prevent the system from being damaged upon start-up.

3. Run-test the equipment after start-up for five consecutive days. Tests shall include operation of all equipment and systems for a period of not less than two 8 hour periods at 90 percent of the full specified capacities.

4. Equipment Start-up Reports: For each equipment or system on which start-up is performed, submit 8 copies of start-up report for review by the Architect.

   a. The start-up report shall include the manufacturer's standard start-up form completed and signed by the start-up technician.

5. Provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for specified tests.

6. Provide electric energy and fuel required for tests.

7. Final adjustment to equipment or systems shall meet specified performance requirements.

8. Equipment, systems, or Work deemed defective during testing shall be replaced or corrected as required. Test until satisfactory results are provided.

F. Specific Coordinated Plan for Test and Balance:

1. Provide a narrative of the operational intent that clearly describes the function and sequence of operation of each component, equipment, or system installed. Instruct designated Owner personnel in the operation of the installed systems.

2. Prior to final test and balance, plumbing equipment and systems shall be operated and tested as indicated in Article 3.04.F above to demonstrate satisfactory overall operation of the installed systems.

3. Welding performed as part of this Division may be subject to radiographic inspections at random in accordance with requirements specified in Section 22 05 13: Basic Plumbing Materials and Methods.

3.5 NOISE AND VIBRATION REDUCTION

A. Correct noise or vibration caused by plumbing systems. Provide all necessary adjustments to specified and installed equipment and accessories to reduce noise to the lowest possible level

B. Correct noise or vibration problems caused by failure to install work in accordance with Contract Documents. Include all labor and materials required as a result of such failure. Pay for re-testing of corrected noise or vibration problems by the project acoustical consultant including travel, lodging, test equipment expenses, etc.

3.6 PROTECTION, CARE AND CLEANING

A. In addition to storage criteria of the General Conditions, and provisions under Section 01 50 00: Construction Facilities and Temporary Controls, the following shall be provided:

1. Provide for the safety and good condition of materials and equipment until Substantial Completion. Protect materials and equipment from damage.

2. Protect installed Work.

3. Replacements: In case of damage, immediately provide repairs and/or replacements as required.

4. Protect covering for bearings, open connections to tanks, pumps, compressors and similar equipment.

5. Interior of piping shall be maintained free of dirt, grit, dust, and other foreign materials.

6. Fixtures, piping, finished brass or bronze, and equipment shall have grease, adhesive, labels, and foreign materials removed. Chromium, nickel plate, polished bronze or brass Work shall be polished. Glass shall be cleaned inside and out.

7. Before initial start-up and again before Substantial Completion, piping shall be drained and flushed to completely remove grease and foreign matter. Pressure regulating assemblies, traps, strainers, boilers, flush valves, and similar items shall be thoroughly cleaned. Tag system with an information tag listing responsible party and date of element, before initial start-up and again before Substantial Completion. Compressed air, oil, and gas piping shall be blown out with oil-free compressed air or inert gas.

END OF SECTION

SECTION 22 05 13

BASIC PLUMBING MATERIALS AND METHODS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. This Section prescribes basic materials and methods generally common to the Work of Division 22.

B. Related Requirements:

1. Division 01: General Requirements.

2. Division 22: Plumbing.

3. Division 26: Electrical.

1.2 SUBMITTALS

A. Provide in accordance with Division 01, Section 22 05 00 and specific requirements of each section of Division 22.

B. Types of welding rods to be used.

1.3 QUALITY ASSURANCE

A. Standards: Comply with applicable national, state, and local codes and standards: ASTM, ASME, and ANSI. Federal Specifications, AWWA, SISPI, NFPA, FM, UL, CPC (California Plumbing Code), CMC (California Plumbing Code), CSA.

B. Qualifications of Manufacturer: Products used in the Work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production as reviewed by the Architect.

1.4 COORDINATION

A. Coordinate related Work in accordance with provisions of Section 01 31 13: Project Coordination.

PART 2 – PRODUCTS

2.1 GENERAL

A. Provide the following products if they are indicated in the Contract Documents or if they are required for the proper installation, function or operation of equipment, systems or components indicated in the Contract Document.

B. Provide the following products as a complete assembly with required accessories for a complete and functioning entity in compliance with governing codes and applicable standards as specified in Section 22 05 00, manufacturer's instructions or as required.

1. Omission of minor details in the Contract Documents does not waive and/or otherwise relinquish compliance with the above requirements.

2.2 MANUFACTURERS AND MATERIALS

A. Ball Valves: Bronze, 2-inch and smaller:

BV-1: Class 150, 600 psi, CWP, 2 piece construction reinforced Teflon seats, full port, adjustable packing gland, stainless ball and stem, threaded ends.

Hammond UP-8303A/UP-8305/UP-8513, NIBCO T-685-80-LF/TS-685-66-LF, Milwaukee UPBA400S/450S, or equal.

BV-2: Class 150, 600 psi, CWP two piece construction with reinforced TFE seats, full port, adjustable packing gland, (no threaded stem designs allowed), threaded ends.

NIBCO T-685-80-LF, Hammond UP-8303A, Milwaukee UPBA-400 or equal.

NIBCO T585 S6R66 (Stainless Steel), Milwaukee BA-260 (Stainless Steel).

BV-3 Class 150, 600 psi CWP, 2-piece construction, bronze body, reinforced Teflon seats, adjustable packing gland, (no threaded stem designs allowed), threaded ends.

Hammond UP8301A, NIBCO T-585-70, Milwaukee BA-400, or equal.

Ball Valves in Insulated Piping: Use extended operating handle of non-thermal conducive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation and memory stops that are fully adjustable after insulation is applied. NIBCO Nib-Seal Handle.

B. Butterfly Valves: (NOT USED)

C. Check Valves:

1. Bronze, 2-inch and smaller:

CHV-1: 200 psi, CWP horizontal swing, Y pattern, renewable seat and disc, threaded ends.

NIBCO T-413-Y-LF, Milwaukee UP-509, Hammond UP-904 or equal.

CHV-2: Class 125 200 psi, swing check, bronze body, Teflon disc, soldered ends.

Stockham B-310TY, Crane 1340, NIBCO S-413-Y, Milwaukee 1509-T, Hammond IB-912 or equal.

CHV-3: 200 psi, CWP, bronze body, horizontal swing, Y pattern, renewable seat and disc, solder ends.

Nibco S-413-Y-LF, Milwaukee UP 1509-T, Hammond Up-946 or equal.

2. Cast Iron 2 1/2-inch and larger:

CHV-4: Class 125, 200 psi, CWP, IBBM, renewable seat and disc, bolted cap, threaded ends:

Crane 372, Stockham G-927, NIBCO T-918-B, or equal.

CHV-5: Special low-pressure check valve for installation in gas lines.

Circle Seal Products Co.

119B-PP-0-15 psi; #1:1/8 inch IPS; #2:1/4 inch IPS #3:3/8 inch IPS.

D. Earthquake Valve:

EQV-1 Mechanically triggered by seismic movement, complying with state of California seismic response specifications, UL listed and certified by D.S.A. Size and pressure as required or indicated on Drawings. (Minimum 1/4 psi, maximum 10 psi. Earthquake valve shall shut off gas automatically during an earthquake to prevent an explosion or fire. Valve shall be Koso California seismic valve, or equal.

1. Not sensitive to vibrations caused by passing trucks or accidental bumping.

2. Sensitive to wide amplitude G's only. Preset at factory for the correct G-rating.

3. Positive sealing from minus 10 degrees F. to 150 degrees F.

4. Visual open-close indicator.

5. Manual reset.

6. Plumb line for mounting.

7. Tripping mechanism has non-creeping rolling latch.

8. Install valve per manufacturer’s recommendations only.

E. Expansion Tank: (NOT USED)

F. Flow Control Valve – Manual: (NOT USED)

G. Gate Valves: (NOT USED)

H. Globe Valves:

1. Bronze, 2-inch and smaller:

GLV-1A Class 125, 200 psi, CWP, screw-in bonnet, Teflon disc, threaded ends:

Milwaukee UP 502, Hammond UP 440 or equal.

GGLV-2 Class 125, 200 psi, CWP, screw in bonnet, Teflon disc, solder ends.

Hammond IB-418, Milwaukee 1502, NIBCO S-211-Y, or equal.

GLV-2A: Class 125, 200 psi, CWP, screw in bonnet, Teflon disc, soldered ends.

Milwaukee UP 1502, Hammond UP 418 or equal.

I. Heater Vent Pipe: (NOT USED)

J. Liquid Level Gage: (NOT USED)

K. Piping:

1. Piping shall be continuously and permanently marked with manufacturer's name, type of material, size, pressure rating, and the applicable ASTM, ANSI, UL, or NSF listing. On plastic pipe, date of extrusion must also be marked.

2. Underground non-ferrous pressure pipes shall be installed with proper color tracer wires. Refer to color code provisions in Section 22 05 53: Plumbing Identification.

P-1 Cast iron: Hubless, service weight, ASTM A888, CISPI 301, conforming to CISPI 310 and installed in accordance to IAPMO 1S 06. American Foundry, Tyler, or AB & I or equal.

P-2 Galvanized steel, Schedule 40, ASTM A53., US Steel or equal.

P-3 Copper drainage tube, underground, type L hard, ASTM B 88, Mueller, Cerro Brass or equal.

P-4 Copper drainage tube, inside structure and above grade. Type DWV hard temper, ASTM B 306, Mueller, Anaconda, Cerro Brass, Cambridge-Lee, Halstead or equal.

P-5 Purple pipe, PVC, schedule 40 for reclaimed or recycled water (below ground only for non-potable irrigation systems), type 1, grade 1, PVC-1120, Cell Class 12454 B.

P-6 Copper water tube, Type L hard, ASTM B88. Mueller, Cambridge-Lee, Halstead or equal. (when used above ground only)

P-7 Copper water tube, Type K hard, ASTM B88, by Mueller, Cerro Brass, Cambridge-Lee, Halstead or equal.

P-8 Polyethylene plastic pipe, ASTM D 2513, standard dimension ratio. 11, rated at 80 psi working pressure at 73 degrees Fahrenheit (F). for 3-inch and smaller, SDR 11.5 rated at 76 psi at 73 degrees F. for 4-inch and above, butt or socket type fittings, joined by heat fusion, orange or yellow color.

CPCHEM (Chevron Phillips Chemical Company LP) PE 2406, or equal.

P-9 Red seamless brass 85-5-5-5, iron pipe size (IPS), threaded pipe, ASTM B43. Mueller, Cerro Brass, Cambridge-Lee, Halstead or equal.

P-10 Black steel pipe, Schedule 40, ASTM A53, Type E, ERW by US Steel, or equal.

P-11 Seamless copper tubing, tempered drawn, Type M, ASTM B88 by Mueller, Cerro Brass or equal.

P-12 High Silicon Iron Casting, 1 ½-inch and 2-inch, threaded for science room vents when ferrous waste piping is provided, ANSI-A21.10, WWP-356-36, ASTM D1784-699, by Duriron or equal.

P-13 PVDF (Polyvinylidene Fluoride) schedule 40 pipes, conforming to ASTM F1673, ASTM D3222 and complying with UL723 (ASTM E84). The joints may be no-hub or

electro-fusion type. Installer shall be certified by manufacturer for joint installation. Orion, Fuseal or equal.

P-14 Polypropylene chemical waste, flame retardant pipe, conforming to ASTM F1412 and ASTM D4101. The joints may be no-hub or electro-fusion type. Installer shall be certified by the manufacturer for joint installation. Orion, Fuseal or equal.

P-15 PVC, thick wall, cast-iron OD sized, UL listed, AWWA listed, NSF listed, Class 200 with tracer wire, Blue Brute, or equal.

P-16 Type 316L Stainless steel chemical waste pipe, marked with manufacturer's identification and fittings. Mechanical press fit joints with EPDM seals Manufacturer's representative shall instruct installers and certify them for joint installation. Piping system shall be provided with a five-year manufacturer's material warranty.

Blucher-Josam or equal.

P-17 304 / 304L Stainless Steel, .049 wall, ASTM A312. Pipe must be certified for use with the Vic-Press 304TM piping system, by Trent Tube, Victaulic or equal.

P-18 CPVC (Chlorinated polyvinyl Chloride) schedule 40 pipe, conforming to ASTM D1784 and complying with UL723 (ASTM E84). The joints shall be of solvent cement type conforming to ASTM F493. Installer shall be certified by the manufacturer for this type of joint installation. Spears, Corzan, Charlotte or equal.

P-19 PVC, schedule 40, extruded from 100 percent virgin Polyvinyl Chloride (PVC) compound, meeting requirements of class 1254-13 of ASTM D1784.

L. Pipe Fittings:

PF-1 Cast iron, soil or waste no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 2 bands for size 1 ½-inch thru 4-inch, IAPMO, ASTM C 564 and CISPI 310.

American Foundry, Mission, Tyler, or equal.

PF-2 Cast iron, soil or waste, Heavy-duty no-hub coupling with neoprene gaskets, stainless steel corrugated shields and stainless steel clamps. 4 bands for size 5-inch thru 10-inch. IAPMO, ASTM C564 and CISPI 310.

American Foundry, Mission, Tyler, or equal.

PF-3 Malleable iron, Class 150, threaded, galvanized, beaded, ANSI B 16.3. P-2

Stockham, Stanley Flagg, Grinnell Oreual.

PF-4 Cast brass drainage fittings ASA B 16.23, ASTM B 42. Provide with copper drainage tube.

Mueller Brass, Nibco, Stanley Flagg, Lee Brass Or equal.

PF-5 Wrought copper - solder type ANSI B 16.22

Mueller Brass, Nibco, Lee Brass or equal.

PF-6 Polyethylene plastic fittings, ASTM D 3261 and D 2683, standard dimension ratio 11, rated at 80 psi working pressure at 73 degrees F. for 3 inches and smaller, SDR 11.5 rated at 76 psi at 73 degrees F. for 4 inches and above, butt or socket type fittings, joined by heat fusion, color orange or yellow.

CPCHEM, (Chevron Phillips Chemical Company LP) or equal.

PF-7 Polyethylene transition risers, for Pff-6 above, Transition fitting must have a minimum vertical height of 36 inches from the horizontal connection which will allow for a 6-inch steel riser above ground. Polyethylene transition risers shall be anodeless.

Central Plastics Company or equal.

PF-8 Bronze and brass, 250 psi, threaded, ASA B16.17 and F S WW-P-460.

Mueller Brass, Lee Brass Or equal.

PF-9 Malleable iron, Class 125, ANSI B 16.3, threaded or welded Schedule 40 black steel for 2-inches and below and welded for 2 ½-inch and above, by Stockham or equal.

PF-10 Cast iron, threaded, Class 125, ANSI B 16.1.

Stockham or equal.

PF-11 Cast-iron OD sized,, bell and spigot gasket joints.

PF-12 Steel butt weld type, ASTM A 234WPB.

PF-13a No-hub couplings for factory grooved PVDF or polypropylene, schedule 40 piping. The coupling shall be of the same material and gauge as the pipe. Each coupling shall have 300 series stainless steel outer band and 5/16 inch bolts, nuts and washers plated to meet a 100-hour salt spray test per ASTM B117. Installer shall be certified by the manufacturer for this type of joint installation. Orion, Fuseal or equal.

PF-13b The pipe and fitting shall be joined using the socket fusion system conforming to ASTM 2657. Installer shall be certified by the manufacturer for this kind of joint installation. Orion, Fuseal or equal.

PF-13c CPVC (Chlorinated Polyvinyl Chloride) schedule 40 pipe and fittings, conforming to ASTM D1784 and complying with UL723 (ASTM E84), shall be joined using solvent cement conforming to ASTM F493. Installer shall be certified by the manufacturer for this kind of joint installation. Spears, Corzan or equal.

PF-14a Drains, bottle traps and similar devices for CPVC, PVDF or polypropylene, schedule 40 piping, shall be of same material and gauge as the pipe with mechanical joints. Installer shall be certified by the manufacturer for this kind of joint installation. Orion, Fuseal or equal.

PF-14b Type 316L Stainless steel joint for chemical waste piping systems including drain or bottle traps. Blucher-Josam or equal.

Victaulic Vic Press 304TM or equal.

PF-15 Precision cold drawn austenitic 304/304L stainless steel, with elastomer O-rings

PF-16 Grooved end type– ASTM A395 and A536 ductile iron; ASTM A234 WPB forged steel; fabricated from ASTM A53 carbon steel. Couplings shall be supplied with angle-pattern bolt pads for rigidity, except in locations where flexibility is desired. Gaskets shall be pre- lubricated. Galvanized or painted, by Victaulic or equal.

PF-17 Grooved end type– ASTM B75 or B152 and ANSI B16.22 wrought copper, bronze sand casting per ASTM B584-87 copper alloy CDA 836 per ANSIbB16.18. Couplings shall be CTS style 606 supplied with angle pattern bolt pads for rigidity, coated with copper coated alkyd enamel. Gaskets shall be pre-lubricated Flush seal type by Victaulic or equal.

PF-18 CPVC fittings must conform to ASTM D2846 specification for chlorinated polyvinylchloride (CPVC) plastic for hot and cold water distribution system.

PF-19 Plastic fittings, schedule 40 molded from PVC type I compound, conforming to the requirements of specification ASTM D2466.

M. Pipe Isolators:

PLA-1 Absorption pad shall be not less than ½ inch thick, unloaded. Pad shall completely encompass pipe.

Holdrite, LSP, Stoneman, Potter-Roemer, Trisolator, PR-Isolator, or equal.

Hydra-Zorb Cushion Clamps, Acousto-Clamp, or equal.

N. Pressure Gage: Aluminum or steel case, minimum 4 ¼-inch dial; pressure type or combination vacuum-pressure type, with provisions for field calibration. Dial indicator to indicate pressure in psi with accuracy to within plus or minus 0.5 percent of maximum dial reading. Furnish gages with restriction screw, size 60, to eliminate vibration impulses. Black case and ring, bourdon tube of seamless copper alloy with brass tip and socket. Three way gage cock, constructed of brass with stuffing box, 1/2 inch couplings, with fixed or movable cap nut to shut off pressure gage.

PG-1 Pressure type, black drawn steel case, 4-1/2-inch glass dial, range approximately twice line pressure.

Marsh Keckley, Trerice, Weksler, Weiss, or equal.

O. Plug Valves:

PV-1 2 inches and smaller: Rockwell No.114, lubricated plug type, 200-pound., water operating gauge pressure iron body and plug, regular pattern, threaded, with indicating arc; by Walworth, Homestead, WKM, or equal.

PV-2. 2 ½-inch and larger: Rockwell No.115 and No.165 lubricated plug type, 200 pound water operating gauge. Iron body and plug, regular pattern, flanged, with indicating arc. Walworth, Homestead, WKM, or equal.

P. Safety Relief Valves:

SRV-1 Combination temperature and pressure relief type. CSA approved. Set to open at 125 psi pressure.

Watts 40L Cash-Acme NCLX-1

SRV-2 Same as SRV-1, except provide on storage type water heater with anode in dip tube.

Watts 10 x L, Cash-Acme NCLX-1

SRV-3 Spring type, ASME and NB stamped and certified with manual lifting device for air or gas.

Bailey, Cash-Acme, Watts, Keckley or equal.

Q. Strainers:

STR-1 Description: Wye type with monel or stainless steel strainer cylinder (manufacturer's standard mesh), and gasketed machine strainer cap. Where indicated on Drawings, provide with valved (globe valve) blowout piping, same size as blowout plug.

1. 2-inch and smaller:

   C.M. Bailey No.100-A, 250 lb., cast iron body, threaded, Keckley 'B', Spirax Sarco Y-type, or equal.

2. 2 ½-inch and larger:

   C.M. Bailey No.100-A, 125 lb., cast iron body, flanged, or Victaulic style 732, 300 psi, ductile iron body, grooved, fusion bonded epoxy coated.

   C.M.Bailey, Armstrong, Muessco, Keckley 'A', or equal.

STR-2 Y pattern cast iron bodies, 125 psi, monel screen. Open area at least twice the cross-sectional area of IPS pipe in which strainer is installed and may be woven wire or perforated type. Screwed ends for sizes up to 2 inches, flanged ends fusion bonded epoxy coated for 2 ½-inch and larger perforations, in accordance with the following:

1. Steam service - 40 square mesh.

2. Other services - 16 square mesh.

Bailey No.100, Armstrong, RP&C, Keckley or equal.

STR-3 Flanged, bucket type, semi-steel body, 125 psi, stainless steel screen with 1/8 inch diameter perforations, all sizes.

Bailey No.1, Zurn 150 Series, RP&C, Keckley GFV or equal.

STR-4 Grooved, T-pattern, ductile iron body, 300 psi, stainless steel frame and mesh basket, grooved ends.

R. Vent Caps: (NOT USED)

S. Vacuum Valves: (NOT USED)

T. Protective Coating for Underground Steel Piping Applied to Underground Automotive: (NOT USED)

U. Pipe and Fitting Requirements Schedule: Unless otherwise specified or indicated on Drawings, pipe and fittings shall be installed in accordance with the following table:

TABLE I

PIPE AND FITTING SCHEDULE

Use	Limits	Pipe	Fittings
Domestic Hot and Cold water, underground	Up To8 inches	P-6	PF-5
Copper, underground only		P-7	PF-5
Cold water, underground (Site piping)	4-inch and over	P-15	PF-11
Domestic hot and cold water, in building and above ground	All	P-6	PF-5
In building above ground	2 to 8-inch	P-6	PF-5
Compressed air	Underground or in concrete	P-9	PF-8
	Above ground	P-10	PF-3
Condensate drains and drains From HVAC Equip.		P-6	PF-5
Downspouts, interior above and below grade, up to 5 feet from building.		P-1	PF-1 Or PF-2
Acid Vent	All	P-12	PF-10
Fire Mains (Fire Hydrant)	Underground	P-15	PF-11
Gas Natural	Underground	P-8	PF-6
Gas Natural	Above ground	P-10	PF-9
Copper Drainage Tube (Underground)	Waste and Vent	P-3	PF-4
Copper Drainage Tube (Above Ground)	Waste and Vent	P-4	PF-4
Vents	New Building	P-1	PF-1 or PF-2 (IRE) if required by engineer
Vents	Existing Buildings and Exposed Downspouts	P-2	PF-3

Vents	For acid waste lines underground	P-13, 14, 16, 17, 18	PF- 13a, 13b, 13c, 14a, 14b or 15
Waste lines, Sanitary		P-1	PF-1 or PF-2 (IRE) if required by engineer
Waste lines, Acid	To nearest water dilution jet	P-13, 14, 16, 17, 18	PF- 13a, 13b, 13c,14a, 14b or 15

V. Flanges: Flanges shall be furnished and installed at each flanged connection of each type of equipment, tanks, and valves. Faces of flanges being connected shall be furnished alike. Connection of a raised face flange to a flat-faced flange is not permitted. Flanges shall conform to following schedules:

TYPE OF PIPE	FLANGE
Screwed black or galvanized grooved steel pipelines.	125 pound black cast iron screwed flange, flat faced or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Welded or grooved steel pipe, except high pressure steam lines.	150 pound black forged steel welding flanges, 1/16 inch raised face ASTM A 105, Grade II or grooved flange adapters, Victaulic Style 741, Tyco-Grinnell Fig. 71, Gruvlok Fig. 7401, or equal.
Copper and brass pipe or tubing.	150 pound cast bronze, flat-faced flange with solder end or grooved flange adapters, Victaulic Style 641, Tyco-Grinnell Fig. 61, Gruvlok Fig. 6084, or equal.

1. Gasket material for flanged connections shall be full faced or ring type to suit facing on flanges and shall be furnished in accordance with following schedule

SERVICE	TYPE
Cold water	1/16 inch thick neoprene

Grooved end flange adapters supplied with pressure responsive elastomeric Gaskets supplied with grooved flange adapters shall be pre-lubricated by the manufacturer. Grade of gasket to suit intended service.

W. Unions:

1. Unions shall be furnished and installed in accordance with the following requirements (unless flanges are furnished):

   a. At each threaded or soldered connection to equipment and tanks, except in Freon or fuel gas, piping systems, whether indicated or not.

   b. Immediately downstream of any threaded connection to each manually operated threaded valve or cock, and each threaded check valve, yard box or access box except those in Freon piping systems, whether indicated or not.

c. At each threaded connection to threaded automatic valves (except those in Freon piping systems) such as reducing valves and temperature control valves, whether indicated or not.

d. If grooved piping is used, couplings shall serve as unions. Additional unions are not required

2. Unions shall be located so that piping can be easily disconnected for removal of equipment, tank, or valve.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which Work of this Section shall be performed. Correct conditions detrimental to proper and timely completion of Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Provide all materials and equipment for the Work. Furnish and install necessary apparatus, parts, materials, and accessories.

B. Pipe Installation:

1. Install piping parallel to wall and provide an orderly grouping of proper materials and execution.

2. Piping shall clear obstructions, preserve headroom, provide openings and passageways clear, whether indicated or not. Verify the Work of other Divisions to avoid interference.

3. If obstructions or the Work of other Divisions prevent installation of piping or equipment as indicated by the Drawings, perform minor deviations as required by the Architect.

4. Install piping after excavation or cutting has been performed. Piping shall not be permanently enclosed, furred in, or covered before required inspection and testing is performed.

5. Exposed polished or enameled connections from fixtures or equipment shall be installed with no resulting tool marks or threads at fittings. Residue or exposed pipe compound shall be removed from exterior of pipe.

6. Piping shall be concealed in chases, partitions, walls, and between floors, unless otherwise directed or specifically noted on Drawings. When penetrating wood studs, joists, and other wood members, provide such members with reinforcement steel straps of Continental Steel & Tube Co., ULINE, Independent Metal Strap, or equal.

7. Reduce fitting where any change in pipe size occurs. Bushings shall not be furnished unless specifically reviewed by the Architect, or indicated on Drawings.

8. Piping subject to expansion or contraction shall be anchored in a manner, which permits strains to be evenly distributed. Swing joints or expansion loops shall be installed. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping. Seismic loops required at all building separations.

9. Immediately after lines have been installed, openings shall be capped or plugged to prevent entrance of foreign materials. Caps shall be left in place until removal is necessary for completion of installation.

10. Couplings shall not be installed except where required pipe runs between other fittings are longer than standard length of type of pipe being installed and except where their installation is specifically reviewed by the Architect.

11. Water piping shall be installed generally level, free of traps, unnecessary offset, arranged to conform to building requirements, clear of ducts, flues, conduits, and other Work. Piping shall be arranged with valves installed to provide for complete drainage and control of system. Piping shall not be installed which causes an objectionable noise from flow of water therein under normal conditions. Refer to Section 23 0500: Common Work Results for Plumbing.

12. Water lines may be installed in same trench with sewer lines, provided bottom of water line is 12 inches minimum above top and to the side of sewer line.

13. Changes in pipe sizes shall be furnished with eccentric reducers, flat on top. Offsets to clear obstruction shall not be installed so as to produce air pockets.

C. Pipe Sleeves and Plates:

1. Provide pipe sleeves of Schedule 40 black steel pipe or Schedule 40 PVC plastic pipe in concrete or masonry walls, footings, and concrete floors below grade. Provide adjustable submerged deck type sleeves at locations where pipes pass through concrete floors, except concrete slab floors on grade, and at locations where soil pipe for floor type water closets passes through concrete floors.

2. Sleeves shall provide ½ inch clearance around pipes, except plastic pipe shall have 1 inch clearance. Caps of deck type sleeves shall be removed just prior to installation of pipe. Area around sleeves shall be smooth and without high or low spots. Sleeves in walls shall not extend beyond exposed surface of wall. Sleeves in concrete floors and walls shall be securely fastened to forms to prevent movement while concrete is being placed.

3. Piping installed on a roof shall clear the roof surface by 10 inches minimum, with or without insulation. Bottom of individual fittings may infringe on 10 inches clear space but not groups of fittings or fittings located within 27 inches of each other.

4. Stiles shall be provided to facilitate crossing of piping when parallel piping runs are laterally greater than 12 inches out-to-out, or any pipe is higher than 18 inches, and more than 40 feet long or runs between two or more major pieces of equipment or housings greater than 20 feet apart. Stiles shall be not less than 20 inches wide with a minimum tread depth of 10 inches. Where stiles are required, they shall be located so greatest obstructed distance is 30 feet.

5. Where pipes pass through waterproofed walls, floors, or floors on grade, sealant with Link-Seal Modular Seals, or equal, between pipe and sleeve to provide a waterproof joint. Where earth is in contact with pipe on both sides of a wall or foundation, the waterproof joint is not required. Commercial rubber compression units may be furnished instead of sealed sleeves if reviewed by the Architect.

6. A swing joint, or other required device, shall be furnished and installed in hot water lines with 10 feet of sealant or compression joint to allow for expansion.

7. Provide polished, chrome-plated flanges when plumbing pipes pass through walls at plumbing fixtures, etcetera as specified in Section 22 4000 Plumbing. Provide polished steel, chromium-plated split floor and ceiling plates at locations where pipes pass through walls, floors, ceilings, and partitions in finished portion that neatly conceals pipe insert.

8. Pipe sleeves shall be provided where pipes intersect footings or foundation walls and sleeve clearances shall provide for footing settlement, but not less than one inch all around pipe.

D. Welding of Pipe and Qualifications of Welder:

1. Joints above grade or accessible conduit or tunnels in steel piping may be either welded or screwed unless specifically indicated otherwise on Drawings or specified. Joints in below grade steel piping, whether in insulation or not, shall not be welded, unless otherwise indicated.

2. Welded joints in pipe shall be continuous around pipe and shall comply with ASME B31: Code for Pressure Piping, unless otherwise specified.

3. Each pipe weld shall be stamped with welder's identification mark. Welding shall be performed by welders possessing a valid certificate of qualification for welding carbon steel welding pipe in horizontal position (2G) and horizontal fixed position (5G) in accordance with the requirements of Section IX of the ASME Boiler and Pressure Vessel Code, by an Owner-recognized, DSA approved testing laboratory.

4. Before any welder performs welding on the Work, furnish the INSPECTOR with a copy of welder's valid qualification papers and obtain verification. Welder qualification is not valid unless it has been issued while welder was performing work for current employer, and has performed type of work described by qualification in the preceding 3 months.

5. Welding performed under these Specifications is subject to special tests and inspections including rigid Ultra Sonic Testing (UT) and radiographic inspection at random, in accordance with Technique for Radiographic Examination of Welded Joints by an Owner recognized, DSA approved testing laboratory.

E. Unacceptable Welds and Repairs to Welding:

1. Welds containing any of the following types of imperfections shall be deemed defective Work:

a. Cracks of any type.

b. Zones of incomplete (in excess of 1/32 inch) fusion or penetration.

c. Elongated slab inclusions longer than 1/4 inch.

d. Groups of slag inclusions in welds having an aggregate length greater than thickness of parent metal in a length 12 times the thickness of the parent metal.

e. Undercuts greater than 1/32 inch.

f. Overlaps, abrupt ridges or valleys.

2. When a defective weld is detected by examination as outlined above, two additional welds shall be radiographed at locations selected by the Project Inspector. If the two selected welds demonstrate compliant welding, then the two tested welds shall be deemed to be in compliance. Welding revealed by radiographs to be defective Work shall be removed, repaired, and tested by radiograph.

3. If either of the two selected welds demonstrates welding deemed to be defective Work, all welding in that portion of the Work shall be deemed defective Work and either: all welds shall be cutout, prepare new ends for welding and weld to comply with this Specification, or radiograph all welds, removing and repairing only such welding deemed to be defective Work.

4. Repair welding shall be performed in a manner in full compliance with ASME B31. The welded joints or repairs shall be spot examined with UT or radiographic tests in accordance with foregoing requirements.

5. Owner shall cause to be performed additional random UT and radiographic examinations of welds. Owner shall be responsible for the costs of any UT and radiographic examinations found to be in compliance with specified requirements.

6. Installer shall be responsible for the costs of UT and radiographic re-examinations of welds deemed defective Work and not in compliance with this Specification, and shall repair or replace said welds in accordance with specified requirements.

F. Welding Rods: Submit a written list of materials and proposed type of welding rods.

G. Backing Rings: Backing rings may be submitted for installation provided the Product Data is submitted with the material list.

H. Qualification Tests for Low-pressure Welding:

1. Tests shall be performed on 3-inch standard weight pipe ASTM A53, Grade A, and shall be welded by acetylene and electric arc. Each sample shall consist of 2 pieces, each 10 inches long, with 30-degree bevel at point weld.

2. Two 20-inch samples shall be performed in the 2G and two 20-inch samples in the 5G positions, with positions defined in Section IX, ASME Boiler and Pressure Vessel Code. Welds shall have the reinforcement ground or machined flush to the surface of the pipe before testing. Samples shall be tested as full section tensile.

3. Weld shall develop a load of 90 percent of 50,000 psi, i.e., 45,000 psi or shall develop a fracture in parent metal.

4. Each qualified welder shall carry an identification card listing welder's name, date of test, and type of welding tests passed; signed by the welder and the laboratory.

5. A valid certificate of qualification issued in compliance with requirements of the ASME Boiler Pressure Vessel Code Section IX shall qualify a welder for issuance of a certificate for low-pressure pipe welding.

I. Certificates of Qualification for Welding of Unfired Pressure Vessels:

1. Certificates of qualification shall be issued by a laboratory recognized by the Owner in compliance with the requirements of the ASME Boiler Pressure Vessel Code Section IX. Qualifications shall be for both acetylene and arc welding of Schedule 40 ASTM

A53, Type B ,steel welded or seamless pipe in the Horizontal Position (2G) and the Horizontal Fixed Position (5G) as defined by said code.

2. Certificate described above is not valid unless it has been issued while welder was working for his current employer, and unless welder has performed type of work described by certificate in the preceding three months. Requirements for possession of a valid certificate shall not be waived for welders fabricating unfired pressure vessels when the Specifications require compliance with ASME code or when welding pipe carries working pressures greater than 75 psi and temperatures greater than 250 degrees F.

J. Pipe Joints and Connections:

1. Pipe and tubing shall be cut per IAPMO Installation Standards. Pipe shall have rough edges or burrs removed so that a smooth and unobstructed flow shall be provided.

2. Hot tapping of gas lines is strictly prohibited.

3. Threaded Pipe: Joints in piping shall be installed according to the following service schedule:

a. Soap Piping: Litharge and glycerine, or Expando, Gasoila, or equal.

b. Plastic Piping: Teflon pipe joint compound tape.

c. Oxygen Piping: Wash treads with S.P., rinse, blow-dry and apply litharge and glycerine.

d. Cleanout Plugs: No compound shall be used. After inspection and test, plugs shall be removed, cleaned, greased, and replaced.

b. Other services furnish sealant, suitable and as reviewed by the Architect.

4. Threads on pipe shall be cut with sharp, clean, unblemished dies and shall conform to ANSI/ASME B2.1 for tapered pipe threads.

5. Joint compounds shall be smoothly placed on male thread and not in fittings. Threaded joints shall be installed tight with tongs or wrenches and sealant of any kind is not permitted. Failed joints shall be replaced with new materials. Installation of thread cement or sealant to repair a leaking joint is not permitted.

6. Sharp-toothed Stillson, or similar wrenches, is not permitted for the installation of brass pipe or other piping with similar finished surfaces.

K. Copper Tubing and Brass Pipe with Threadless Fittings:

1. Silver brazed joints shall be used for attaching fittings to non-ferrous metallic refrigerant piping.

2. Non-pressure gravity fed condensate lines may be soldered with 95/5 solder.

3 Silver brazing alloy, Class BCUP-5. Surfaces to be joined shall be free of oil, grease, and oxides. Socket of fitting and end of pipe shall be thoroughly cleaned with emery cloth and wiped to remove oxides. After cleaning and before assembly or heating, flux shall be installed to each joint surface and spread evenly. Heat shall be applied in accordance with instructions in the Copper Tube Handbook issued by Copper

Development Associates. Joints constructed of rough bronze fittings shall be provided as recommended by manufacturer.

4. Do not overheat piping and fittings when installing silver brazing.

5. Joints in non-ferrous piping for services not covered above shall be installed with solder composed of 95/5 tin/antimony, ASTM B32, Grade 5A. Surfaces to be jointed shall be free of oil, grease, and oxides. Sockets of fitting and end of pipe shall be cleaned with emery cloth to remove oxides. Solder flux shall be sparingly installed and solder added until joint is completely filled. Do not overheat. Excess solder, while plastic, shall be removed with a small brush in order to provide an uninterrupted fillet completely around joint. Random inspection of joints shall be conducted by Project Inspector to ensure joints are lead-free.

6. Grooved end joints for copper piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

L. Ring-Type Pipe: Joints shall be installed in accordance with manufacturer's instructions with grooved couplings, fittings and rubber rings. Couplings and pipe shall be compatible and of the same manufacturer. Rings shall be accurately located and installed by grooves in coupling. Pipe shall be installed with zero deflection unless otherwise specified. Pressure pipe shall be furnished with thrust blocks at each offset point.

M. Welded Pipe Joints:

1. Joints in welded steel pipelines shall be installed by oxyacetylene or electric arc process. Welding shall be continuous around pipe and provided as specified.

2. Butt welds shall be of the single V-type, with ends of pipe and fittings beveled approximately 37 ½ degrees. Piping shall be aligned before welding is started with the alignment maintained during welding.

3. Welds for flanges and socket fittings shall be of the fillet type with a throat dimension not less than pipe wall thickness.

N. Grooved End Pipe Joints: Grooved end joints for carbon steel piping shall be assembled in accordance with the latest manufacturer recommendations. Pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to grove for proper gasket sealing. Grooving tools shall be as manufactured by Victaulic, RIDGID, MAG Tool, or equal.

O. Joints shall be Vic-Press 304TM, or equal, made with Victaulic Series ‘PFT’ tools and the appropriate sized jaw. Pipe shall be certified for use with Vic-Press 304TM system, and shall be square cut, properly deburred and cleaned, and marked at the required location to insure full insertion into the fittings and/or couplings.

P. Polyethylene (Plastic) Pipe:

1. Joints shall be installed by the heat fusion method, in accordance with manufacturer's recommendations and IAPMO installation standard IS 12, for natural gas.

2. Pipe Riser at Meter, Regulator and Building Wall: Prefabricated, anodeless type, utilizing a grade level transition between underground polyethylene pipe and gas

supply steel pipe of riser outlet, R. W. Lyall Co., or equal. Below grade to above grade transition shall be installed in a welded, epoxy coated, steel casing.

3. Connections to Existing Pipe Line or Branch:

   a. Steel-to-plastic (PE): Provide manufacturer's prefabricated standard transition fitting, transition from epoxy-coated steel pipe to plastic, R. W. Lyall Co., or equal.

   b. Plastic-to-plastic, PVC to PE: Provide manufacturer's prefabricated standard transition fitting, transition from PVC to epoxy-coated steel pipe to PE; R.W. Lyall Co., or equal..

   c. Plastic-to-plastic, PE to PE: Provide manufacturer's standard fused tapping tee assembly with shut-off feature.

4. Provide PE reinforcing sleeves where PE pipe is fused to multi-saddles, service punch tee, reducing tees, transition fittings and anodeless risers.

Q. Valves: Valves shall conform to the following:

1. Piping systems shall be furnished with valves at points indicated on Drawings and specified, arranged to provide complete regulating control of piping system throughout building and the Project site.

2. Valves shall be installed in a neat grouping, so that parts are easily accessible and maintained.

3. Valves shall be full size of line in which they are installed, unless otherwise indicated on Drawings or otherwise specified, and shall be one of types specified.

4. Provide chain operators on valves 2-inch and larger located 7 feet or more above the servicing floor level.

5. Valves for similar service shall be of one manufacturer.

6. Except where otherwise specified, valves shall be Belimo, Victaulic, Stockham, Crane, Jenkins, Milwaukee, Hammond, American, NIBCO, Hoffman, or equal.

7. Ball valves below grade in yard boxes shall have stainless steel handles.

8. Hose bibs in dense garden areas shall be ¾ inch in size with one hose bib in the lunch pavilion 1 inch in size. Other hose bibs shall be ¾ inch lock shield type. Bibs shall be furnished with vacuum breaker protection.

9. Safety valves and pressure relief valves shall have stamp of approval as required by ASME and shall be provided with annual test lever. Where a hot water storage tank is heated by means of a coil, pressure relief valve shall have a steam BTU discharge rating of the coil. Discharge pipe from safety or pressure relief valves shall be not less than one pipe size larger than inlet pipe size of valve. Discharge pipe shall terminate as indicated and shall be free of traps. In addition to locations specified, pressure relief valves shall be installed in the following locations:

   a. On discharge side of each pressure-reducing valve.

b. On each water heater connected to a hot water storage tank and other pressure vessels.

c. On cold water line to each water heater or hot water storage tank when there is a check valve, backflow prevention valve or similar device between water heater or hot water storage tank and meter or relief valve at the pressure reducing valve assembly.

d. On discharge side of each air compressor.

e. On each air receiver connected to an air compressor.

10. Temperature relief valves and combination temperature and pressure relief valves shall be as specified and furnished as set forth in this Section. Discharge pipe from relief valves shall be not less than discharge area of valve or valves it connects, based on discharge area of valves, and shall terminate as indicated and free of any traps. Valves shall be installed at following locations:

11. A combination temperature and pressure relief valve or combination of valves on each heating hot water storage tank. Temperature sending element shall extend into water inside tank.

12. Manual air vent valve assemblies shall be installed at each high point of hot water space heating and chilled water piping systems. Valves shall discharge through 1/4 inch diameter copper tubing and drain to nearest floor sink. Automatic type air vent valve shall only be installed where specifically indicated. Radiator, convectors, and finned pipe convectors shall be fitted with packless radiator valves, angle or straight pattern. Each convector or radiator installed as part of a space hot water heating system shall be furnished with a manual-type air vent valve.

R. Strainers: Strainers shall be installed on each water main (except for fire line) downstream of the meter, above grade, when a pressure regulator assembly is not installed. Main strainer shall be of Y-flange or groove type. On closed loop chilled and heating hot water systems pump systems, a strainer shall be installed at each pump inlet and upstream of each flow control valve assembly. The control valve assembly may include a modulating temperature control valve and a flow-limiting valve, manufactured by Griswold, AutoFlow, Flow Control Industries, Inc., or equal.

S. Hangers and Supports:

1. Piping shall be securely fastened to building structure by approved iron hangers, supports, guides, anchors, and sway braces to maintain pipe alignment to prevent sagging and to prevent noise or excessive strain on piping due to uncontrolled or seismic movement under operating conditions. Hangers and supports shall conform to Manufacturer's Standardization Society Specification SP-69. Hangers shall be relocated as required to correct unsatisfactory conditions that may become evident when system is placed into operation. Appliances, heat exchangers, storage tanks, and similar equipment shall be securely fastened to structure in accordance with seismic requirements. Outdoor metal hangers and supports shall be hot-dipped galvanized steel, unless otherwise specified.

2. Hose faucets, compressed air outlets, and similar items at ends of pipe branches shall be rigidly fastened to building construction near point of connection.

3. Piping shall not be supported by wire, rope, wood, plumbers' tape, or other non-recognized devices.

4. Hangers and supports shall be designed to support weight of pipe, fittings, weight of fluid and weight of pipe insulation, and shall have a minimum factor of safety of five, based on ultimate tensile strength of material installed.

5. Burning or welding of any structural member under load is not permitted. Field welding not specified on Drawings or reviewed Shop Drawings is not permitted without review by Architect and DSA.

6. Burning holes in beam flanges or other structural members is not permitted without review by the Architect and DSA.

7. Pipe hangers on piping covered with low temperature insulation shall be installed on outside of insulation and not in contact with pipe unless otherwise detailed on Drawings. Insulation shall be protected by 18 gage galvanized steel shield, with a minimum length of 10 inches, installed completely around pipe covering between covering and hanger. Installing hangers directly on pipe and butting adjoining sections of insulation against hanger is permitted provided void and hanger rod are properly insulated and sealed so that no sweating occurs at hangers.

8. Hanger rods shall be fastened to structural steel members with suitable beam clamps. Clamps shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

   a. Tolco I beam, Fig.62 for maximum 1000 pounds.

   b. Tolco I or WF beam, Fig. 329, for maximum of 1290 pounds.

9. Hanger rods shall be fastened to concrete inserts in concrete slabs or beams. Inserts shall be Tolco, Carpenter & Patterson, Fee and Mason, or equal, as follows:

   a. Tolco Fig.310 for maximum of 600 pounds.

   b. Tolco Fig. 309 for maximum of 1140 pounds.

10. For fastening to wood ceilings, beams, or joists, furnish Grinnell Fig. 128R, Grinnell Fig. 153, Tolco 78, or equal pipe hanger flange fastened with drive screws. Under wood floors, 3/8 inch hanger rods shall be hung from 2-inch by 2-inch by 1/4 inch angle clips 3 inches long, with 2, staggered 10d nails, clinched over joist.

11. Hanger rod sizes for copper, iron, or steel pipe: 3/8 inch for pipe sizes ½ inch through 2-inch, ½ inch for pipe sizes 3-inch, 4-inch and 5-inch, 5/8 inch for pipe size 6-inch, and ¾ inch for 8-inch and 10-inch pipe.

12. Turnbuckles, if furnished, shall provide a load carrying capacity equal to that of the pipe hanger with which they are being installed.

13. Pipe hangers shall be of same size, or nearest larger manufactured size available, as pipe or tubing on which they are being installed.

14. Hangers, clamps, and guides furnished for support of non-metallic pipe shall be padded with 1/8 inch thick rubber, neoprene, or soft resilient cloth.

15. Where special pipe-supporting requirements in the Specifications conflict with any standard requirements specified herein, the Specification requirements shall govern.

16. Vertical Piping:

a. Vertical pipe risers shall be securely supported with riser clamps of recognized type. Risers in reinforced concrete buildings shall be furnished with extension clamps fastened to pipe above each concrete floor slab with extended arms of clamp to rest on slab. Clamps shall be provided with lead or Teflon liners when installed on copper tubing. Clamps shall be plastic-coated when installed on non-ferrous pipe or tubing.

b. Copper tubing in sizes 1 ½-inches and larger and steel pipelines passing up through building shall be supported at each floor of building or every 15 feet whichever is less.

c. Copper tubing sizes 1 ¼-inches and smaller shall be supported at not intervals not more than 6 feet on center. Special provisions shall be installed for vertical lines subject to expansion and contraction caused by operating temperature differences.

d. Vertical cast iron pipelines shall be supported from each floor and at its base. Malleable iron or steel pipe clamps with minimum thickness of 1/4 inch shall be furnished and fastened around pipe for support.

17. Horizontal Piping:

a. Roof Mounted Piping: Pressure and non-pressure piping shall be supported from channels, stands, clamps, trapezes, rollers, or structures mounted on 100% rubber, UV resistant rooftop supports with reflective strips, Dura-Block, or equal. Roller type supports shall be provided below and above pipe to prevent its dislodgement. Bottom of pipes shall clear the roof surface by 10 inches.

b. Insulated steam and space heating hot water insulated condensate lines, insulated domestic hot water supply and return piping shall be supported with Tolco Figure 4, B-Line Figure B3140, Grinnell Figure 212, or equal, steel hangers with welded eye rods to permit hinge movement at point of attachment of hangers. Hinge movement at point of support shall be provided by welded eye linked rods Tolco Figure 101L, B-Line Figure B3211X, Grinnell Figure 278, or equal.

c. Domestic cold water piping, water supply and return piping, condenser water piping, insulated refrigerant piping gas piping, compressed air piping, cast iron soil piping, galvanized steel vents, waste and downspout piping and glass to be supported with Tolco Figure 1, B-Line Figure B3100, Grinnell Figure 260, or equal, hangers with rods, turnbuckles and inserts suitable for above hangers.

d. Maximum hanger and support spacing shall conform to CPC schedule for horizontal piping installed above grade.

18. A hanger or support shall be installed close to the point of change in direction of a pipe run, in either a horizontal or vertical plane.

19. When practicable, supports and hangers for cast iron soil pipe shall be installed as close as possible to joints and when hangers or supports are not located within one foot of a branch line fitting, an additional hanger or support shall be installed at fitting.

20. In systems where grooved piping is used, couplings shall be provided with angle pattern bolt pads to comply with support and hanging requirements of ANSI/ASME B31.1, ANSI/ASME B31.9, and NFPA Pamphlet 13.

T. Flashings:

1. Each pipe, duct, or gas-fired equipment vent passing through roof shall be installed with waterproof flashing.

2. Flashing or flanges on pipes, vents, and ducts passing through a tile or slate roof shall be constructed of sheet lead. Flashing for pipes and heater vents passing through a roof shall be 4 pound soft sheet lead. Flashing and flanges for ducts and heater vents passing through exterior walls shall be 22 gage sheet metal. Flanges and flashing shall be installed waterproof at point of connection with pipe or duct. No soldered joints on roof flashings will be allowed.

3. Lead flashing and flanges shall be constructed of 4 pound sheet lead with burned joints. Flange of lead flashing or lead flange on a duct shall extend out onto roof a minimum of 12 inches from pipe or duct. Lead flashing shall extend up the pipe or duct not less than 7 inches.

4. Sheet metal flashing shall be constructed of 24 gage galvanized sheet steel. Flanges on these flashings shall extend out onto roof a minimum of 10 inches from pipe or duct. Flanges on ducts through exterior walls shall extend out from duct a minimum of 2 ½ inches. Flanges on gas-fired equipment single-wall vents shall be of ventilated type. Type B gas vents through a roof shall be furnished with non-ventilated flashing as per NFPA Pamphlet 211.

5. Cast iron, steel, brass, and copper pipe, which terminates less than 18 inches above roof, shall be furnished with a combination counter-flashing and vandal-proof hood for protection against water, birds and foreign matter. Cast iron, steel, brass and copper pipe, which does not terminate within 18 inches of roof, shall be furnished with a counter-flashing sleeve. Pipe, which terminates more than 18 inches above roof, shall be furnished with protection against entrance of water, birds, and foreign matter.

6. Counter-flashing and combination counter-flashing sleeves and vandal-proof hoods shall be cast iron, vandal-proof, threaded, sealed or approved gas-heated sleeve type. Counter-flashing sleeves on each of these items shall extend down over flashing a minimum of ¾ inch.

7. Flashing and flanges on ducts shall be installed waterproof at point of connection to the duct by riveting and soldering. Storm collars shall be securely screwed and installed waterproof around appliance vent pipe immediately above flashing.

8. Vent piping above roof shall be furnished with a combination counter-flashing sleeve and vandal-proof hood.

U. Equipment Installation: Install roof or floor mounted equipment on level platforms, housekeeping pads or curbs and provide sound, vibration and seismic control measures per Section 23 0548 even if not indicated on Drawings.

END OF SECTION

SECTION 22 05 53

PLUMBING IDENTIFICATION

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Marking and identification on mechanical piping systems, ducts, controls, valves, and apparatus.

B. Related Requirements:

1. Division 01: General Requirements

3. Section 22 05 13: Basic Plumbing Materials and Methods.

4. Section 22 10 00: Plumbing.

5. Section 22 20 13: Plumbing Piping.

1.2 SUBMITTALS

A. Submit in accordance with Division 01 and Section 22 05 00: Common Work Results for Plumbing.

B. Submit product data and installation instructions for each item specified.

C. Submit Samples of materials.

1.3 QUALITY ASSURANCE

A. Comply with provisions of:

1. Section 22 05 00: Common Work Results for Plumbing.

2. ANSI/ASME A13.1: Scheme for the Identification of Piping Systems.

3. APWA: Uniform Color Code.

4. IAPMO: Uniform Plumbing Code (UPC)

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, shall be permanently identified.

2.2 VALVES

A. Furnish prepared chart or diagram for each piping system, indicating by identifying letter or model number of each valve in the system, its location, and function.

B. Install charts in aluminum frame with clear glass front and secure on wall where designated by the Project Inspector.

C. Bind copies of each chart in operating instructions manual.

D. Provide each valve with a brass, aluminum, or plastic disc, not less than 1-1/4 inches diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger"); submit Sample tag to the Architect for review.

2.3 INSTRUMENTS AND CONTROLS

A. Identify panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to panel boards.

B. Identify alarm indicating devices and alarm reset devices by nameplates.

C. Identify automatic valves, flow switches, and pressure switches, with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.4 EQUIPMENT

A. Identify each major piece of equipment with engraved bakelite nameplates permanently affixed to the equipment, indicating the room numbers it services, Equipment identification designation shall be the same to its designation indicated on the “As-Built Drawings”. Room numbers in the nameplates shall correspond to the final room numbers.

2.5 ABOVE GRADE PIPE IDENTIFICATION

A. Identify pipes by means of colored labels with directional flow arrows and identification of the pipe content, in conformance to ANSI/ASME A13.1 or the UPC.

B. Materials: Precoiled acrylic plastic with clear polyester coating, all-temperature, self-adhering, as manufactured by Brady, Brimar Industries, Seton, Stranco, Inc., or equal.

C. Size:

Outside Diameter of Pipe or Insulation (in inches)	Length of Color Field (in inches)	Size of Letter (in inches)
¾ to 1 ¼	8	½
1 ½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
over 10	32	3 ½

D. Locations:

1. On accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where contained material is obvious due to its connection to fixtures (such as faucets, water closets, etcetera.).

2. Near each valve and branch connection in such accessible piping.

3. At each pipe passage through wall or floor.

4. At not more than 20 feet spacing on straight pipe run between bands required in 2 and 3 above.

5. At each change in direction.

E. Application: Install on clean surfaces free of dust, grease, oil, or any material that will prevent proper adhesion. Replace non-adhering or curling labels with new labels.

F. Color Schedule:

Content of Pipe	Legend	Background Color	Lettering Color
Domestic cold water	Domestic. C.W.	Green	White
Non-potable cold water	Caution: Non-potable Water Do Not Drink (1)(2)	Purple	Black
Domestic hot-water 140ºF	Domestic H.W. 140ºF	Blue	Black
Sanitary waste	San waste	Green	White
Sanitary vent	San vent	Green	White
Storm drain or downspout	Storm drain	Green	White
Indirect drain	Ind drain	Green	White
Sump pump discharge	Pump discharge	Green	White
Fire sprinkler supply	Fire Sprinkler supply	Red	White
Fire sprinkler drain	Sprinkler drain	Red	White
Fuel oil	Diesel oil	Yellow	Black
Gas	Gas	Yellow	White
Reclaimed Water	Caution: Reclaimed Water Do Not Drink (1)(3)	Purple	Black

H. Notes on Schedule:

1. Note (1) indicates 2 ¼ inch by 1 inch yellow label with ½ inch letters reading UNSAFE WATER at one end of primary label.

   Note (2) words should read “CAUTION: NONPOTABLE WATER DO NOT DRINK.” with international *do not drink* symbol.

   Note (3) words should read “CAUTION: RECLAIMED WATER DO NOT DRINK.” with international *do not drink* symbol.

2.6 UNDERGROUND PIPE

A. Detectable Marking Tape:

1. Provide and install detectable marking tape along buried piping. Tape shall be specifically manufactured for marking and locating underground utilities with electronic equipment. Tape shall be acid and alkali resistant, and manufactured with integral wires or foil backing, encased with protective cladding. Tape shall be a minimum of two inches in width.

2. Manufacturer: Reef Industries, Inc., Advantage Brands, Inc., Northtown Company, Mutual Industries, Inc., or equal.

3. Detectable marking tape shall be color-coded per APWA Color Code:

   a. Yellow: Oil and gas.

   b. Blue: Water, irrigation and slurry lines.

   c. Green: Sewer and drain lines.

B. Tracer Wire:

1. Solid copper wire type THWN, 12 AWG gauge, with heat and moisture resistant insulation.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Correct detrimental conditions prior to commencing the Work of this Section. Install markers and identification tags as specified with materials and installation procedures recommended by manufacturer.

B. Place tracer wire on top of non-metal utility lines allowing some slack. Do not wrap tracer wire around pipe. Fasten tracer wire in place at approximately 10 feet on centers with non-metal ties.

C. Install underground detectable pipe marking tape continuously buried 8 to 10 inches above the buried utility pipe. Wrap tape on pipe risers up to a height of 12 inches above grade.

3.2 CLEANUP

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

END OF SECTION

SECTION 22 10 00

PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Labor, materials, tools, and equipment to install plumbing systems as indicated.

B. Related Sections:

1. Division 01 - General Requirements.

2. Section 22 05 00: Common Work Results for Plumbing.

3. Section 22 05 13: Basic Plumbing Materials and Methods.

4. Section 22 05 53: Identification for Plumbing piping and Equipment.

5. Section 22 07 00: Plumbing Insulation.

1.2 SUBMITTALS

A. Provide in accordance with Division 01 and Section 22 05 00: Common Work Results for Plumbing.

B. Provide necessary documentation to Owner for processing rebates for water efficient fixtures.

1.3 QUALITY ASSURANCE

A. Unless otherwise noted, the California Plumbing Code is hereby made part of this section.

B. Conform to provisions of Section 22 05 00: Common Work Results for Plumbing.

C. Manufacturer of plumbing products must be third-party certified to ANSI/NSF Standard 61, Section 9 certification, and ANSI/NSF 372 to demonstrate compliance with the federal requirements for lead contribution to drinking water, the Safe Drinking Water Act SDWA, and the California Health and Safety Code Section 116875.

1.4 PRODUCT HANDLING

A. Conform to provisions of Section 22 05 13: Basic Plumbing Materials and Methods.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Materials: Refer to Section 22 05 13: Basic Mechanical Materials and Methods.

B. Insulation for Piping: Refer to Section 23 07 00: Plumbing Insulation.

2.2 FIXTURES AND DRAINS

A. General: Fixtures specified shall be furnished complete with trim and fittings. Cast iron plumbing fixtures shall be acid resistant enamel, and identified by casting letters "AR" or words "acid-resistant" into metal. Fixtures shall be white unless otherwise specified. Cast iron fixtures shall be white enamel inside and on back, rim and apron, with exposed unfinished surfaces painted white. Fixtures of same general classifications shall be of same make.

B. Finished Brass:

1. Unless otherwise specified, finished brass of a similar type shall be of same manufacturer and model throughout buildings.

2. Finished and exposed brass equipment, except floor, shower and urinal drains shall be chromium-plated and polished. Floor, shower and urinal drains, unless otherwise specified, shall be nickel-bronze metal.

C. Traps, Trap Arms and Tailpieces:

1. Fixture traps shall be all cast brass, chromium-plated and polished. (No tubular traps). Exceptions as follows:

a. Traps that are an integral part of a fixture.

b. Traps concealed in floors, walls and furring.

c. Traps standard for service sinks and Industrial Shop equipment.

d. Laboratory traps and tailpieces shall be as specified in section 22 07 00.

“Basic Plumbing Materials and Methods”

2. Concealed traps and 17 gage tailpieces may be rough brass finish, except as otherwise specified. Laboratory traps and tailpieces shall be as specified in Section 22 07 00: Basic Plumbing Materials and Methods. Furnish chromium-plated and polished cast brass wall flanges with setscrews and chromium-plated and polished brass casing on discharge side of each trap.

3. Tailpieces shall be not lighter than 17 gage, brass, chromium-plated, and polished. Furnish and install chromium brass plated wall flanges with set screws and chromium-plated 20 gage brass casing on discharge side of each chrome-plated all cast trap.

3.1 GAS SERVICE

A. Above Grade Service: Pipe shall be steel, hammered, free of dirt and scale, and blown out with oil-free air or nitrogen to a clean, dry condition. Piping shall not be installed in or through a ventilation duct or plenum.

B. Underground Service, Gas approved (yellow) Polyethylene Plastic Pipe:
Refer to Section 22 05 13: “Basic Plumbing Materials and Methods”.

1. Pipes shall be joined with polyethylene fitting and joined together by thermal fusion in accordance with procedures recommended by Polyethylene plastic pipe and fitting manufacturer.

2. Plastic pipe shall be installed not less than 30 inches below grade..

3. Underground Warning Tape shall be installed 12 inches above buried gas piping. Warning tape shall be yellow with caution statement as follows: “CAUTION – BURIED GAS LINE BELOW”.

4. Plastic pipe shall not be installed in or under a building or structure. Pipe shall be installed under bituminous surfacing or compacted soil area, free from large stones. Pipe may be installed under sidewalks or driveways, as long as no joint occurs. Pipe installed under paved covered areas wider than 40 feet shall be installed in ventilated conduits extending 2 feet past paving.

5. Pipe shall be installed on a 6 inches deep sand bed. After required pressure-leak test, pipe shall be covered with sand not less than 6 inches thick.

6. Piping shall not support weight of valves, metal fittings or other items. Pipe shall be installed strain free.

7. Plastic pipe fittings shall not be stored or left exposed to sunlight. Pipe in open trenches shall be shielded. A sand envelope of 6 inches minimum shall be placed around pipe, with exception of joints, until inspection by IOR is completed. Protection for pipe shall be provided when necessary to leave pipe exposed overnight.

8. Installer of piping is required to have training and to have attained a certification. Non-trained/Non-certified installer must contact the manufacturer or manufacturer’s representative to provide on-site fusion training and certification, prior to work commencement

9. Polyethylene plastic pipe shall connect to a steel epoxy coated anodeless type riser to minimum of 6 inches above grade, when exiting the underground installation and transitioning to steel pipe connection.

10. Where a steel pipe riser passes into a structure or building, a double swing or double-offset joint shall be furnished. Pipe shall pass into structure 6-inches above grade and through a sleeve with a minimum one inch clearance. An isolation valve is required before pipe entering the building.

3.2 VALVES ON PLUMBING SYSTEM

A. Furnish and install gates, ball, globes, angles, and check valves on plumbing Work at following locations whether indicated on drawings or not.

B. Hot and cold valves shall be:

1. Lead free complying with AB1953.

2. Above the ground copper water system, 2-inch and larger, may utilize Victaulic butterfly valves and fittings for their connections. A 2-inch or larger Victaulic valve may be in a wall if an adequately sized access panel is provided for maintenance or removal.

C. Valves shall be accessible and installed within an access panel approximately 3 feet above floor and no more than 7 feet above floor, or in a marked yard box to prevent tampering.

1. Immediately after each water meter, in addition to any valve furnished by utility company, there shall be an accessible valve on the inlet side for a strainer assembly, dual backflow device assembly and/or possibly a dual pressure reducing valve assembly.

2. A gate or ball valve on each water supply before it enters building. Valves shall be accessible from outside building and shall be installed in a marked yard box, unless otherwise indicated on drawings. Ball valves 2 ½-inch size or larger shall omit gate valve handle and furnish 2-inch square operating nut.

3. Install a gate or ball valve on each building branch line, which serves two or more fixtures, when these fixtures are not provided with a group isolation valve as specified above. These valves shall be located approximately 3 feet but not more than 7 feet above finish floor.

4. Install a gate, ball valve or partition stop for hot and cold water supply to plumbing fixtures with no accessible supply stops, such as wall mounted faucets.

5. Install a gate, ball valve or partition stop for stops adjacent to, and controlling water flow to each sill cock and hose bib except as follows:

a. A sill cock immediately below an exterior drinking fountain may be controlled by the same gate, ball valve or partition stop as drinking fountain.

b. Valves or stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only hose bibs and branch line is furnished with a shut-off valve.

6. Install a lose key angle stop, on each exposed fixture supply, and for each flush valve unless otherwise specified,

7. Install gate or ball valve at each location where a water line is connected to a piece of equipment other than items mentioned above.

8. Provide a handle or a key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver them to the project OAR.

3.3 VALVES - GAS SERVICE

A. A gas readily accessible shut-off stop shall be installed on each gas line entering a building immediately prior to the point it enters the building. Unless otherwise specified or indicated, shut-off valves for lines entering a permanent structure, buildings or portable buildings, shall be installed in a vertical riser above grade.

1. Gas shut off valve for portable buildings – A dedicated Gas shut off valve shall be provided in a marked Yard Box, for each portable building to facilitate relocation/removal of building without the need to shut off gas to entire school.

B. Gas Shut off valve within a building – A gas shut off valve with handles shall be accessible and serviceable within an access panel. Install valve minimum 3 feet above floor but less than 7 feet above floor.

C. In addition to locations specified, gas shut off valve shall be installed at following locations:

1. Install a lubricated plug gas shut off valve on any line connected to gas main or header at master assembly.

2. Install a lubricated plug gas shut off valve before entering any building or structure.

3. Install a gas valve on each outlet, in addition to any gas stop furnished with equipment.

4. Service to laboratory gas cocks shall be furnished with a special precision check valve, located downstream from gas stop servicing room outlet at each laboratory cock. Unless otherwise specified, 1/8-inches bore shall be provided for each outlet cock.

5. Install a gas shut-off valve on each gas line serving 2 or more gas outlets in same room. Service stop shall be installed not more than 7 feet above floor, and shall be in the room it serves.

6. Install a gas shut-off valve on inlet side of each gas pressure regulating valve.

7. Gas shut-off valves to be furnished with equipment.

8. Install gas shut-off valve at not more than 1,000 foot intervals on each gas main.

9. At multi-story buildings, provide gas-shut off valve(s) to isolate and control each floor or level. Install valves in a concealed manner in walls with access panels.

10. Gas shut-off valves in classrooms and locations subject to tampering shall be protected while remaining accessible.

D. When a gas-shut off valve adjacent to gas-fired equipment is indicated in Contract Documents it shall be furnished and installed as part of Work of this section.

E. When electrical wall switches with emergency push button are specified for controlling gas outlets at Laboratory Classrooms, provide main shut-off gas valve with normally closed electric solenoid valve within an accessible access panel.

3.4 ELECTROLYSIS PREVENTION

A. Brass nipples, 6 inches, with recognized brass unions; flanges shall be furnished and installed at locations described herein. Flanges shall be installed with complete insulating component consisting of gasket bolt sleeves and bolt washers. Dielectric insulators shall be installed at following locations:

1. Where special applications indicated on Drawings require an insulation flange or brass union, with 6-inch brass nipple to be installed in a condensate line, or steam line, flange insulation shall be of a high temperature type, suitable for continuous operation at temperatures up to 220 degrees F. for condensate and 400 degrees F. for steam.

2. Where steel or cast iron in ground connects to copper or brass piping above ground, transition from steel or cast iron pipe to copper or brass pipe shall be provided in an accessible location.

3. Underground dielectric connections shall be furnished in accessible yard boxes.

4. Above ground dielectric connections shall be exposed; or if in finished rooms shall be located in accessible access boxes.

3.5 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished according to Section 22 05 53: “Plumbing Identification”

B. Under ground Caution Tape shall be placed 12 to 18 inches above the utility line. The Caution Tape shall be a designated color and marked with the appropriate name for the specific type of utility pipe as follows:

1. Yellow – with the words: CAUTION GAS LINE BELOW

2. Blue – with the words: CAUTION WATER LINE BELOW

3.6 HOT WATER CIRCULATING PUMPS (NOT USED)

3.7 WATER TEMPERATURE CONTROLLERS (NOT USED)

3.8 DEPTH OF SEWER LINES

A. Minimum depth of below grade sewer lines shall be 24 inches to centerline of pipe. Sewer lines shall slope ¼ inch per foot minimum, unless otherwise indicated. Minimum depth at Owner property line shall be 6 feet, unless otherwise required.

3.9 BACKFLOW PREVENTION DEVICES

A. Backflow Devices: Installation of backflow devices shall be tested and certified by Ventura County backflow device tester before Substantial Completion. Tests shall be performed in presence of Project Inspector. Test reports shall be turned over to Project Inspector for mailing to proper agency.

3.10 CLEANUP

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

3.11 PROTECTION

A. Protect Work of this section until Substantial Completion.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. This Section includes the following:

1) Piping materials and installation instructions common to most piping systems.

2) Transition fittings.

3) Dielectric fittings.

4) Mechanical sleeve seals.

5) Sleeves.

6) Escutcheons.

7) Grout.

8) HVAC demolition.

9) Equipment installation requirements common to equipment sections.

10) Painting and finishing.

11) Concrete bases.

12) Supports and anchorages.

1.3 DEFINITIONS

a. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

b. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

c. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

d. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.

e. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

f. The following are industry abbreviations for plastic materials:

1) CPVC: Chlorinated polyvinyl chloride plastic.

2) PE: Polyethylene plastic.

3) PVC: Polyvinyl chloride plastic.

g. The following are industry abbreviations for rubber materials:

1) EPDM: Ethylene-propylene-diene terpolymer rubber.

2) NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

a. Product Data: For the following:

1) Transition fittings.

2) Dielectric fittings.

3) Mechanical sleeve seals.

4) Escutcheons.

b. Welding certificates.

1.5 QUALITY ASSURANCE

a. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

b. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1) Comply with provisions in ASME B31 Series, "Code for Pressure Piping."

2) Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

c. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and

conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

a. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

b. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

a. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.

b. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

c. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 PRODUCTS

2.1 MANUFACTURERS

a. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1) Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2) Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

a. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.

b. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

a. Refer to individual Division 23 piping Sections for special joining materials not listed below.

b. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1) ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a) Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.

b) Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2) AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

c. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

d. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

e. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

f. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

g. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

h. Solvent Cements for Joining Plastic Piping:

1) CPVC Piping: ASTM F 493.

2) PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

i. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.4 DIELECTRIC FITTINGS

a. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

b. Insulating Material: Suitable for system fluid, pressure, and temperature.

c. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

1) Manufacturers:

a) Capitol Manufacturing Co.

b) Central Plastics Company.

c) Eclipse, Inc.

d) Epco Sales, Inc.

e) Hart Industries, International, Inc.

f) Watts Industries, Inc.; Water Products Div.

g) Zurn Industries, Inc.; Wilkins Div.

d. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.

1) Manufacturers:

a) Capitol Manufacturing Co.

b) Central Plastics Company.

c) Epco Sales, Inc.

d) Watts Industries, Inc.; Water Products Div.

e. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1) Manufacturers:

a) Advance Products & Systems, Inc.

b) Calpico, Inc.

c) Central Plastics Company.

d) Pipeline Seal and Insulator, Inc.

2) Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.

f. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1) Manufacturers:

a) Calpico, Inc.

b) Lochinvar Corp.

g. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1) Manufacturers:

a) Perfection Corp.

b) Precision Plumbing Products, Inc.

c) Sioux Chief Manufacturing Co., Inc.

d) Victaulic Co. of America.

2.5 MECHANICAL SLEEVE SEALS

a. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1) Manufacturers:

a) Advance Products & Systems, Inc.

b) Calpico, Inc.

c) Metraflex Co.

d) Pipeline Seal and Insulator, Inc.

2) Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

3) Pressure Plates: Stainless steel. Include two for each sealing element.

4) Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.6 SLEEVES

a. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

b. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

c. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

d. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1) Underdeck Clamp: Clamping ring with set screws.

e. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

f. PVC Pipe: ASTM D 1785, Schedule 40.

g. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.7 ESCUTCHEONS

a. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

b. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

c. One-Piece, Cast-Brass Type: With set screw.

1) Finish: Polished chrome-plated.

d. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1) Finish: Polished chrome-plated.

e. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

f. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.

g. One-Piece, Floor-Plate Type: Cast-iron floor plate.

h. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.8 GROUT

a. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1) Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2) Design Mix: 5000-psi, 28-day compressive strength.

3) Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.1 HVAC DEMOLITION

a. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.

b. Disconnect, demolish, and remove HVAC systems, equipment, and components indicated to be removed.

1) Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

2) Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.

3) Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

4) Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

5) Equipment to Be Removed: Disconnect and cap services and remove equipment.

6) Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

7) Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

c. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

a. Install piping according to the following requirements and Division 23 Sections specifying piping systems.

b. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

c. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

d. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

e. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

f. Install piping to permit valve servicing.

g. Install piping at indicated slopes.

h. Install piping free of sags and bends.

i. Install fittings for changes in direction and branch connections.

j. Install piping to allow application of insulation.

k. Select system components with pressure rating equal to or greater than system operating pressure.

l. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1) New Piping:

a) Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b) Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.

c) Insulated Piping: One-piece, stamped-steel type with spring clips.

d) Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

e) Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.

f) Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw or spring clips.

g) Bare Piping in Equipment Rooms: One-piece, cast-brass type.

h) Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

m. Permanent sleeves are not required for holes formed by removable PE sleeves.

n. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

1) Cut sleeves to length for mounting flush with both surfaces.

a) Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2) Install sleeves in new walls and slabs as new walls and slabs are constructed.

3) Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

a) PVC Pipe Sleeves: For pipes smaller than NPS 6.

b) Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

c) Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

1) Seal space outside of sleeve fittings with grout.

4) Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

o. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1) Install steel pipe for sleeves smaller than 6 inches in diameter.

2) Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

3) Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

p. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1) Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

r. Verify final equipment locations for roughing-in.

s. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

a. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.

b. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

c. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

d. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

e. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

f. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1) Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2) Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

g. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

h. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

i. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1) Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.

2) CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3) PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4) PVC Nonpressure Piping: Join according to ASTM D 2855.

j. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

k. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

l. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1) Plain-End Pipe and Fittings: Use butt fusion.

2) Plain-End Pipe and Socket Fittings: Use socket fusion.

m. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.4 PIPING CONNECTIONS

a. Make connections according to the following, unless otherwise indicated:

1) Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2) Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3) Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

4) Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.5 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

a. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

b. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

c. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

d. Install equipment to allow right of way for piping installed at required slope.

3.6 PAINTING

a. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

b. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.7 CONCRETE BASES

a. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1) Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2) Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

3) Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.

4) Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

5) Install anchor bolts to elevations required for proper attachment to supported equipment.

6) Install anchor bolts according to anchor-bolt manufacturer's written instructions.

7) Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Cast-in-Place Concrete."

3.8 ERECTION OF METAL SUPPORTS AND ANCHORAGES

a. Refer to Division 05 Section "Metal Fabrications" for structural steel.

b. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.

c. Field Welding: Comply with AWS D1.1.

3.9 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

a. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.

b. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

c. Attach to substrates as required to support applied loads.

3.10 GROUTING

a. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

b. Clean surfaces that will come into contact with grout.

c. Provide forms as required for placement of grout.

d. Avoid air entrapment during placement of grout.

e. Place grout, completely filling equipment bases.

f. Place grout on concrete bases and provide smooth bearing surface for equipment.

g. Place grout around anchors.

h. Cure placed grout.

END OF SECTION 23 05 00

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

a. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1) Motor controllers.

2) Torque, speed, and horsepower requirements of the load.

3) Ratings and characteristics of supply circuit and required control sequence.

4) Ambient and environmental conditions of installation location.

PART 2 PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

a. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

b. Comply with NEMA MG 1 unless otherwise indicated.

c. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

a. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

b. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

a. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1) Permanent-split capacitor.

2) Split phase.

3) Capacitor start, inductor run.

4) Capacitor start, capacitor run.

b. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

c. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

d. Motors 1/20 HP and Smaller: Shaded-pole type.

e. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

a. This Section includes the following hangers and supports for HVAC system piping and equipment:

1) Steel pipe hangers and supports.

2) Trapeze pipe hangers.

3) Metal framing systems.

4) Thermal-hanger shield inserts.

5) Fastener systems.

6) Pipe stands.

7) Equipment supports.

b. Related Sections include the following:

1) Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.

2) Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-protection piping.

3) Division 23 Section " Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.

4) Division 23 Section " Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.

5) Division 23 Section(s) "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

a. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

b. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

a. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

b. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

c. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

a. Product Data: For the following:

1) Steel pipe hangers and supports.

2) Fiberglass pipe hangers.

3) Thermal-hanger shield inserts.

4) Powder-actuated fastener systems.

b. Shop Drawings: Signed and sealed by a qualified professional engineer**.** Show fabrication and installation details and include calculations for the following:

1) Trapeze pipe hangers. Include Product Data for components.

2) Metal framing systems. Include Product Data for components.

3) Fiberglass strut systems. Include Product Data for components.

4) Pipe stands. Include Product Data for components.

5) Equipment supports.

c. Welding certificates.

1.6 QUALITY ASSURANCE

a. Welding: Qualify procedures and personnel according to the following:

1) AWS D1.1, "Structural Welding Code--Steel."

2) AWS D1.3, "Structural Welding Code--Sheet Steel."

3) AWS D1.4, "Structural Welding Code--Reinforcing Steel."

4) ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 PRODUCTS

2.1 MANUFACTURERS

a. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1) Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

a. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

b. Manufacturers:

1) AAA Technology & Specialties Co., Inc.

2) Bergen-Power Pipe Supports.

3) B-Line Systems, Inc.; a division of Cooper Industries.

4) Carpenter & Paterson, Inc.

5) Empire Industries, Inc.

6) ERICO/Michigan Hanger Co.

7) Globe Pipe Hanger Products, Inc.

8) Grinnell Corp.

9) GS Metals Corp.

10) National Pipe Hanger Corporation.

11) PHD Manufacturing, Inc.

12) PHS Industries, Inc.

13) Piping Technology & Products, Inc.

14) Tolco Inc.

c. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

d. Nonmetallic Coatings: Plastic coating, jacket, or liner.

e. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

a. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

a. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

b. Manufacturers:

1) B-Line Systems, Inc.; a division of Cooper Industries.

2) ERICO/Michigan Hanger Co.; ERISTRUT Div.

3) GS Metals Corp.

4) Power-Strut Div.; Tyco International, Ltd.

5) Thomas & Betts Corporation.

6) Tolco Inc.

7) Unistrut Corp.; Tyco International, Ltd.

c. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

d. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

a. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

b. Manufacturers:

1) Carpenter & Paterson, Inc.

2) ERICO/Michigan Hanger Co.

3) PHS Industries, Inc.

4) Pipe Shields, Inc.

5) Rilco Manufacturing Company, Inc.

6) Value Engineered Products, Inc.

c. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

d. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

e. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

f. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

a. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1) Manufacturers:

a) Hilti, Inc.

b) ITW Ramset/Red Head.

c) Masterset Fastening Systems, Inc.

d) MKT Fastening, LLC.

e) Powers Fasteners.

b. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1) Manufacturers:

a) B-Line Systems, Inc.; a division of Cooper Industries.

b) Empire Industries, Inc.

c) Hilti, Inc.

d) ITW Ramset/Red Head.

e) MKT Fastening, LLC.

f) Powers Fasteners.

2.7 PIPE STAND FABRICATION

a. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

b. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1) Manufacturers:

a) ERICO/Michigan Hanger Co.

b) MIRO Industries.

c. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1) Manufacturers:

a) MIRO Industries.

d. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.

1) Manufacturers:

a) ERICO/Michigan Hanger Co.

b) MIRO Industries.

c) Portable Pipe Hangers.

2) Base: Stainless steel.

3) Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.

4) Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

e. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.

1) Manufacturers:

a) Portable Pipe Hangers.

2) Bases: One or more plastic.

3) Vertical Members: Two or more protective-coated-steel channels.

4) Horizontal Member: Protective-coated-steel channel.

5) Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

f. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 EQUIPMENT SUPPORTS

a. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.9 MISCELLANEOUS MATERIALS

a. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

b. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1) Properties: Nonstaining, noncorrosive, and nongaseous.

2) Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

a. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

b. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

c. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

d. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

e. Use padded hangers for piping that is subject to scratching.

f. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.

2) Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.

3) Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.

4) Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

5) Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6) Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.

7) Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

8) Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

9) Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.

10) Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.

11) Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.

12) U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

13) Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.

14) Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.

15) Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16) Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.

17) Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18) Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.

19) Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20) Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.

21) Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

g. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.

2) Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

h. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.

2) Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3) Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4) Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

5) Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

i. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2) Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.

3) Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.

4) Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.

5) Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.

6) C-Clamps (MSS Type 23): For structural shapes.

7) Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.

8) Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.

9) Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10) Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

11) Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.

12) Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a) Light (MSS Type 31): 750 lb.

b) Medium (MSS Type 32): 1500 lb.

c) Heavy (MSS Type 33): 3000 lb.

13) Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

14) Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15) Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

j. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2) Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3) Thermal-Hanger Shield Inserts: For supporting insulated pipe.

k. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1) Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.

2) Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3) Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.

4) Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5) Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

6) Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.

7) Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

8) Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

a) Horizontal (MSS Type 54): Mounted horizontally.

b) Vertical (MSS Type 55): Mounted vertically.

c) Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

l. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

m. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

n. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

3.2 HANGER AND SUPPORT INSTALLATION

a. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

b. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1) Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.

2) Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

c. Fiberglass Pipe Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

d. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

e. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled fiberglass struts.

f. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

g. Fastener System Installation:

1) Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.

2) Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

h. Pipe Stand Installation:

1) Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2) Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

i. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

j. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

k. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

l. Install lateral bracing with pipe hangers and supports to prevent swaying.

m. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

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

o. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.

p. Insulated Piping: Comply with the following:

1) Attach clamps and spacers to piping.

a) Piping Operating above Ambient Air Temperature: Clamp may project through insulation.

b) Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.

c) Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.

2) Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3) Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a) Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4) Shield Dimensions for Pipe: Not less than the following:

a) NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.

b) NPS 4: 12 inches long and 0.06 inch thick.

c) NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.

d) NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.

e) NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5) Pipes NPS 8 and Larger: Include wood inserts.

6) Insert Material: Length at least as long as protective shield.

7) Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

a. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

b. Grouting: Place grout under supports for equipment and make smooth bearing surface.

c. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

a. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

b. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

c. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1) Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2) Obtain fusion without undercut or overlap.

3) Remove welding flux immediately.

4) Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

a. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

b. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches

3.6 PAINTING

a. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

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

b. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

c. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 23 05 29

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. This Section includes the following:

1) Isolation pads.

2) Isolation mounts.

3) Restrained elastomeric isolation mounts.

4) Freestanding and restrained spring isolators.

5) Housed spring mounts.

6) Elastomeric hangers.

7) Spring hangers.

8) Spring hangers with vertical-limit stops.

9) Pipe riser resilient supports.

10) Resilient pipe guides.

11) Seismic snubbers.

12) Restraining braces and cables.

13) Steel vibration isolation equipment bases.

1.3 DEFINITIONS

a. IBC: International Building Code.

b. ICC-ES: ICC-Evaluation Service.

c. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

a. Seismic-Restraint Loading:

1) Site Class as Defined in the CBC.

1.5 SUBMITTALS

a. Product Data: For the following:

1) Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2) Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

a) Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.

b) Annotate to indicate application of each product submitted and compliance with requirements.

3) Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

b. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1) Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.

a) Coordinate design calculations with wind load calculations required for equipment mounted outdoors.

2) Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3) Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4) Seismic-Restraint Details:

a) Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

b) Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c) Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

c. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

d. Welding certificates.

e. Qualification Data: For testing agency.

f. Field quality-control test reports.

g. Operation and Maintenance Data: For air-mounting systems to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

a. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

b. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

c. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

d. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Ace Mountings Co., Inc.

2) Amber/Booth Company, Inc.

3) California Dynamics Corporation.

4) Isolation Technology, Inc.

5) Kinetics Noise Control.

6) Mason Industries.

7) Vibration Eliminator Co., Inc.

8) Vibration Isolation.

9) Vibration Mountings & Controls, Inc.

10) M.W. Sausse & Co., Inc.

b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1) Resilient Material: Oil- and water-resistant neoprene.

c. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1) Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2) Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

d. Restrained: All-directional mountings with seismic restraint.

1) Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2) Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

e. Spring: Freestanding, laterally stable, open-spring isolators.

1) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

2) Minimum Additional Travel: 50 percent of the required deflection at rated load.

3) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

4) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

5) Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.

6) Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

f. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1) Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2) Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

4) Minimum Additional Travel: 50 percent of the required deflection at rated load.

5) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

g. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1) Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.

2) Base: Factory drilled for bolting to structure.

3) Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

h. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

i. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1) Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3) Minimum Additional Travel: 50 percent of the required deflection at rated load.

4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6) Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7) Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

j. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1) Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2) Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3) Minimum Additional Travel: 50 percent of the required deflection at rated load.

4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6) Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7) Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

8) Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

k. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.

l. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Amber/Booth Company, Inc.

2) California Dynamics Corporation.

3) Isolation Technology, Inc.

4) Kinetics Noise Control.

5) Mason Industries.

6) Vibration Eliminator Co., Inc.

7) Vibration Isolation.

8) Vibration Mountings & Controls, Inc.

9) M.W. Sausse & Co., Inc.

b. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1) Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

a) Include supports for suction and discharge elbows for pumps.

2) Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3) Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.3 SEISMIC-RESTRAINT DEVICES

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Amber/Booth Company, Inc.

2) California Dynamics Corporation.

3) Cooper B-Line, Inc.; a division of Cooper Industries.

4) Hilti, Inc.

5) Kinetics Noise Control.

6) Loos & Co.; Cableware Division.

7) Mason Industries.

8) TOLCO Incorporated; a brand of NIBCO INC.

9) Unistrut; Tyco International, Ltd.

10) M.W. Sausse & Co., Inc.

b. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1) Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

c. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1) Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.

2) Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.

3) Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

d. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

e. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

f. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

g. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

h. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

i. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

j. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

k. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.4 FACTORY FINISHES

a. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1) Powder coating on springs and housings.

2) All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.

3) Baked enamel or powder coat for metal components on isolators for interior use.

4) Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 EXECUTION

3.1 EXAMINATION

a. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

b. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

c. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

a. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

b. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

c. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

a. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

b. Equipment Restraints:

1) Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2) Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

3) Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

c. Piping Restraints:

1) Comply with requirements in MSS SP-127.

2) Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3) Brace a change of direction longer than 12 feet.

d. Install cables so they do not bend across edges of adjacent equipment or building structure.

e. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

f. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

g. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

h. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

i. Drilled-in Anchors:

1) Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2) Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3) Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4) Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.

5) Set anchors to manufacturer's recommended torque, using a torque wrench.

6) Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

a. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.5 FIELD QUALITY CONTROL

a. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

b. Tests and Inspections:

1) Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2) Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3) Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4) Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5) Test to 90 percent of rated proof load of device.

6) Measure isolator restraint clearance.

7) Measure isolator deflection.

8) Verify snubber minimum clearances.

9) Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

10) Air-Mounting System Operational Test: Test the compressed-air leveling system.

11) Test and adjust air-mounting system controls and safeties.

12) If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

c. Remove and replace malfunctioning units and retest as specified above.

d. Prepare test and inspection reports.

3.7 ADJUSTING

a. Adjust isolators after piping system is at operating weight.

b. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

c. Adjust air-spring leveling mechanism.

d. Adjust active height of spring isolators.

e. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.8 DEMONSTRATION

a. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems. Refer to Division 01 Section "Demonstration And Training."

END OF SECTION 23 05 48

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. Section Includes:

1) Equipment labels.

2) Warning signs and labels.

3) Pipe labels.

4) Duct labels.

5) Stencils.

6) Valve tags.

7) Warning tags.

1.3 SUBMITTALS

a. Product Data: For each type of product indicated.

b. Samples: For color, letter style, and graphic representation required for each identification material and device.

c. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

d. Valve numbering scheme.

e. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

a. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

b. Coordinate installation of identifying devices with locations of access panels and doors.

c. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

a. Metal Labels for Equipment:

1) Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

3) Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

4) Fasteners: Stainless-steel rivets or self-tapping screws.

5) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

b. Plastic Labels for Equipment:

1) Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

2) Letter Color: Black.

3) Background Color: Yellow.

4) Maximum Temperature: Able to withstand temperatures up to 160 deg F.

5) Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6) Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

7) Fasteners: Stainless-steel rivets or self-tapping screws.

8) Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

c. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

d. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the

Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

b. Letter Color: White.

c. Background Color: Red.

d. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

g. Fasteners: Stainless-steel rivets or self-tapping screws.

h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

i. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

a. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

b. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

c. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

d. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1) Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2) Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

b. Letter Color: White.

c. Background Color: Blue.

d. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

f. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

g. Fasteners: Stainless-steel rivets or self-tapping screws.

h. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

i. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1) Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2) Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

a. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1) Stencil Material: Brass.

2) Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.

3) Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

a. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1) Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2) Fasteners: Brass wire-link or beaded chain; or S-hook.

b. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or

modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1) Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

a. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1) Size: Approximately 4 by 7 inches.

2) Fasteners: Brass grommet and wire.

3) Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4) Color: Yellow background with black lettering.

PART 3 EXECUTION

3.1 PREPARATION

a. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

a. Install or permanently fasten labels on each major item of mechanical equipment.

b. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

a. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

b. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1) Identification Paint: Use for contrasting background.

2) Stencil Paint: Use for pipe marking.

c. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1) Near each valve and control device.

2) Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3) Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4) At access doors, manholes, and similar access points that permit view of concealed piping.

5) Near major equipment items and other points of origination and termination.

6) Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7) On piping above removable acoustical ceilings. Omit intermediately spaced labels.

d. Pipe Label Color Schedule:

1) Heating Water Piping:

a) Background Color: White.

b) Letter Color: Red.

3.4 DUCT LABEL INSTALLATION

a. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:

1) Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.

2) ASME A13.1 Colors and Designs: For hazardous material exhaust.

b. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.

c. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

a. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

b. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1) Valve-Tag Size and Shape:

a) Hot Water: 1-1/2 inches, square.

2) Valve-Tag Color:

a) Hot Water: Green.

3) Letter Color:

a) Hot Water: White.

3.6 WARNING-TAG INSTALLATION

a. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 05 53

7SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. This Section includes TAB to produce design objectives for the following:

1) Vibration measuring.

2) Verifying that automatic control devices are functioning properly.

3) Reporting results of activities and procedures specified in this Section.

1.3 DEFINITIONS

a. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

b. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to indicated quantities.

c. Barrier or Boundary: Construction, either vertical or horizontal, such as walls, floors, and ceilings that are designed and constructed to restrict the movement of airflow, smoke, odors, and other pollutants.

d. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

e. NC: Noise criteria.

f. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

g. RC: Room criteria.

h. Report Forms: Test data sheets for recording test data in logical order.

i. Smoke-Control System: An engineered system that uses fans to produce airflow and pressure differences across barriers to limit smoke movement.

j. Smoke-Control Zone: A space within a building that is enclosed by smoke barriers and is a part of a zoned smoke-control system.

k. Stair Pressurization System: A type of smoke-control system that is intended to positively pressurize stair towers with outdoor air by using fans to keep smoke from contaminating the stair towers during an alarm condition.

l. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

m. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

n. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

o. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

p. TAB: Testing, adjusting, and balancing.

q. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

r. Test: A procedure to determine quantitative performance of systems or equipment.

s. Testing, Adjusting, and Balancing (TAB) Firm: The entity responsible for performing and reporting TAB procedures.

1.4 SUBMITTALS

a. Qualification Data: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of evidence that TAB firm and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

b. Contract Documents Examination Report: Within 30 days from Contractor's Notice to Proceed, submit 4 copies of the Contract Documents review report as specified in Part 3.

c. Strategies and Procedures Plan: Within 60 days from Contractor's Notice to Proceed, submit 4 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.

d. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.

e. Sample Report Forms: Submit two sets of sample TAB report forms.

f. Warranties specified in this Section.

1.5 QUALITY ASSURANCE

a. TAB Firm Qualifications: Engage a TAB firm certified by AABC.

b. TAB Conference: Meet with Owner's and Architect's representatives on approval of TAB strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of TAB team members, equipment manufacturers' authorized service representatives, HVAC controls installers, and other support

personnel. Provide seven days' advance notice of scheduled meeting time and location.

1) Agenda Items: Include at least the following:

a) Submittal distribution requirements.

b) The Contract Documents examination report.

c) TAB plan.

d) Work schedule and Project-site access requirements.

e) Coordination and cooperation of trades and subcontractors.

f) Coordination of documentation and communication flow.

c. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:

1) Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2) Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

d. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

e. Instrumentation Type, Quantity, and Accuracy: As described in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems."

f. Instrumentation Calibration: Calibrate instruments at least every six months or more frequently if required by instrument manufacturer.

1) Keep an updated record of instrument calibration that indicates date of calibration and the name of party performing instrument calibration.

1.6 PROJECT CONDITIONS

a. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

a. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.

b. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

c. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

a. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:

1) The certified TAB firm has tested and balanced systems according to the Contract Documents.

2) Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXAMINATION

a. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

1) Contract Documents are defined in the General and Supplementary Conditions of Contract.

2) Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

b. Examine approved submittal data of HVAC systems and equipment.

c. Examine Project Record Documents described in Division 01 Section "Project Record Documents."

d. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

e. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

f. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.

g. Examine system and equipment test reports.

h. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

i. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

j. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

k. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.

l. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.

m. Examine strainers for clean screens and proper perforations.

n. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.

o. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

p. Examine system pumps to ensure absence of entrained air in the suction piping.

q. Examine equipment for installation and for properly operating safety interlocks and controls.

r. Examine automatic temperature system components to verify the following:

1) Dampers, valves, and other controlled devices are operated by the intended controller.

2) Dampers and valves are in the position indicated by the controller.

3) Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.

4) Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.

5) Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.

6) Sensors are located to sense only the intended conditions.

7) Sequence of operation for control modes is according to the Contract Documents.

8) Controller set points are set at indicated values.

9) Interlocked systems are operating.

10) Changeover from heating to cooling mode occurs according to indicated values.

s. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

a. Prepare a TAB plan that includes strategies and step-by-step procedures.

b. Complete system readiness checks and prepare system readiness reports. Verify the following:

1) Permanent electrical power wiring is complete.

2) Automatic temperature-control systems are operational.

3) Equipment and duct access doors are securely closed.

4) Balance, smoke, and fire dampers are open.

5) Isolating and balancing valves are open and control valves are operational.

6) Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.

7) Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

a. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" and this Section.

b. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.

c. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

d. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 PROCEDURES FOR MOTORS

a. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1) Manufacturer, model, and serial numbers.

2) Motor horsepower rating.

3) Motor rpm.

4) Efficiency rating.

5) Nameplate and measured voltage, each phase.

6) Nameplate and measured amperage, each phase.

7) Starter thermal-protection-element rating.

b. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

3.5 PROCEDURES FOR TEMPERATURE MEASUREMENTS

a. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.

b. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

c. Measure outside-air, wet- and dry-bulb temperatures.

3.6 PROCEDURES FOR VIBRATION MEASUREMENTS

a. Use a vibration meter meeting the following criteria:

1) Solid-state circuitry with a piezoelectric accelerometer.

2) Velocity range of 0.1 to 10 inches per second.

3) Displacement range of 1 to 100 mils.

4) Frequency range of at least 0 to 1000 Hz.

5) Capable of filtering unwanted frequencies.

b. Calibrate the vibration meter before each day of testing.

1) Use a calibrator provided with the vibration meter.

2) Follow vibration meter and calibrator manufacturer's calibration procedures.

c. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.

1) Turn off equipment in the building that might interfere with testing.

2) Clear the space of people.

d. Perform vibration measurements after air and water balancing and equipment testing is complete.

e. Clean equipment surfaces in contact with the vibration transducer.

f. Position the vibration transducer according to manufacturer's written instructions and to avoid interference with the operation of the equipment being tested.

g. Measure and record vibration on rotating equipment over 3 hp.

h. Measure and record equipment vibration, bearing vibration, equipment base vibration, and building structure vibration. Record velocity and displacement readings in the horizontal, vertical, and axial planes.

1) Pumps:

a) Pump Bearing: Drive end and opposite end.

b) Motor Bearing: Drive end and opposite end.

c) Pump Base: Top and side.

d) Building: Floor.

e) Piping: To and from the pump after flexible connections.

i. For equipment with vibration isolation, take floor measurements with the vibration isolation blocked solid to the floor and with the vibration isolation floating. Calculate and report the differences.

j. Inspect, measure, and record vibration isolation.

1) Verify that vibration isolation is installed in the required locations.

2) Verify that installation is level and plumb.

3) Verify that isolators are properly anchored.

4) For spring isolators, measure the compressed spring height, the spring OD, and the travel-to-solid distance.

5) Measure the operating clearance between each inertia base and the floor or concrete base below. Verify that there is unobstructed clearance between the bottom of the inertia base and the floor.

3.7 TEMPERATURE-CONTROL VERIFICATION

a. Verify that controllers are calibrated and commissioned.

b. Check transmitter and controller locations and note conditions that would adversely affect control functions.

c. Record controller settings and note variances between set points and actual measurements.

d. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).

e. Check free travel and proper operation of control devices such as damper and valve operators.

f. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.

g. Check the interaction of electrically operated switch transducers.

h. Check the interaction of interlock and lockout systems.

i. Check main control supply-air pressure and observe compressor and dryer operations.

j. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.

k. Note operation of electric actuators using spring return for proper fail-safe operations.

3.8 TOLERANCES

a. Set HVAC system airflow and water flow rates within the following tolerances:

1) Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.

2) Air Outlets and Inlets: 0 to minus 10 percent.

3.9 REPORTING

a. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

b. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

a. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.

b. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.

1) Include a list of instruments used for procedures, along with proof of calibration.

c. Final Report Contents: In addition to certified field report data, include the following:

1) Pump curves.

2) Manufacturers' test data.

3) Field test reports prepared by system and equipment installers.

4) Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

d. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:

1) Title page.

2) Name and address of TAB firm.

3) Project name.

4) Project location.

5) Architect's name and address.

6) Engineer's name and address.

7) Contractor's name and address.

8) Report date.

9) Signature of TAB firm who certifies the report.

10) Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11) Summary of contents including the following:

a) Indicated versus final performance.

b) Notable characteristics of systems.

c) Description of system operation sequence if it varies from the Contract Documents.

12) Nomenclature sheets for each item of equipment.

13) Data for terminal units, including manufacturer, type size, and fittings.

14) Notes to explain why certain final data in the body of reports varies from indicated values.

15) Test conditions for fans and pump performance forms including the following:

a) Settings for outside-, return-, and exhaust-air dampers.

b) Conditions of filters.

c) Cooling coil, wet- and dry-bulb conditions.

d) Face and bypass damper settings at coils.

e) Fan drive settings including settings and percentage of maximum pitch diameter.

f) Inlet vane settings for variable-air-volume systems.

g) Settings for supply-air, static-pressure controller.

h) Other system operating conditions that affect performance.

e. Vibration Measurement Reports:

1) Date and time of test.

2) Vibration meter manufacturer, model number, and serial number.

3) Equipment designation, location, equipment, speed, motor speed, and motor horsepower.

4) Diagram of equipment showing the vibration measurement locations.

5) Measurement readings for each measurement location.

6) Calculate isolator efficiency using measurements taken.

7) Description of predominant vibration source.

f. Instrument Calibration Reports:

1) Report Data:

a) Instrument type and make.

b) Serial number.

c) Application.

d) Dates of use.

e) Dates of calibration.

3.11 INSPECTIONS

a. Initial Inspection:

1) After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the Final Report.

2) Randomly check the following for each system:

a) Measure airflow of at least 10 percent of air outlets.

b) Measure water flow of at least 5 percent of terminals.

c) Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.

d) Measure sound levels at two locations.

e) Measure space pressure of at least 10 percent of locations.

f) Verify that balancing devices are marked with final balance position.

g) Note deviations to the Contract Documents in the Final Report.

b. Final Inspection:

1) After initial inspection is complete and evidence by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner.

2) TAB firm test and balance engineer shall conduct the inspection in the presence of Owner.

3) Owner shall randomly select measurements documented in the final report to be rechecked. The rechecking shall be limited to either 10 percent of the total measurements recorded, or the extent of measurements that can be accomplished in a normal 8-hour business day.

4) If the rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

5) If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

6) TAB firm shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes and resubmit the final report.

7) Request a second final inspection. If the second final inspection also fails, Owner shall contract the services of another TAB firm to complete the testing and balancing in accordance with the Contract Documents and deduct the cost of the services from the final payment.

END OF SECTION 23 05 93

SECTION 23 31 13

METAL DUCTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. Section Includes:

1) Single-wall round ducts and fittings.

2) Sheet metal materials.

3) Sealants and gaskets.

4) Hangers and supports.

b. Related Sections:

1) Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

2) Division 23 Section "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.

3) Division 23 Section "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.

4) Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

a. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated.

1) Static-Pressure Classes:

a) Exhaust Ducts (Negative Pressure): 1-inch wg.

b. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1) Seismic Hazard Level A: Seismic force to weight ratio, 0.48.

2) Seismic Hazard Level B: Seismic force to weight ratio, 0.30.

3) Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

1.4 SUBMITTALS

a. Product Data: For each type of the following products:

1) Sealants and gaskets.

b. Shop Drawings:

1) Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2) Factory- and shop-fabricated ducts and fittings.

3) Duct layout indicating sizes, configuration, liner material, and static-pressure classes.

4) Elevation of top of ducts.

5) Dimensions of main duct runs from building grid lines.

6) Fittings.

7) Reinforcement and spacing.

8) Seam and joint construction.

9) Equipment installation based on equipment being used on Project.

10) Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

11) Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

c. Delegated-Design Submittal:

1) Sheet metal thicknesses.

2) Joint and seam construction and sealing.

3) Reinforcement details and spacing.

4) Materials, fabrication, assembly, and spacing of hangers and supports.

5) Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

d. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1) Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

2) Suspended ceiling components.

3) Structural members to which duct will be attached.

4) Size and location of initial access modules for acoustical tile.

5) Penetrations of smoke barriers and fire-rated construction.

6) Items penetrating finished ceiling including the following:

a) Lighting fixtures.

b) Air outlets and inlets.

c) Sprinklers.

d) Access panels.

e) Perimeter moldings.

e. Welding certificates.

f. Field quality-control reports.

1.5 QUALITY ASSURANCE

a. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

b. Welding Qualifications: Qualify procedures and personnel according to the following:

1) AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2) AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

3) AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

c. Mockups:

1) Before installing duct systems, build mockups representing static-pressure classes in excess of 3-inch wg. Build mockups to comply with the following requirements, using materials indicated for the completed Work:

a) Five transverse joints.

b) One access door(s).

c) Two typical branch connections, each with at least one elbow.

d) Perform leakage tests specified in "Field Quality Control" Article. Revise mockup construction and perform additional tests as required to achieve specified minimum acceptable results.

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

PART 2 PRODUCTS

2.1 SINGLE-WALL ROUND DUCTS AND FITTINGS

a. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1) Manufacturers: Subject to compliance with requirements, provide products by one of the following

a) Lindab Inc.

b) McGill AirFlow LLC.

c) SEMCO Incorporated.

d) Sheet Metal Connectors, Inc.

e) Spiral Manufacturing Co., Inc.

f) Or Equal.

b. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter (diameter of the round sides connecting the flat portions of the duct).

c. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1) Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

d. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1) Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

2) Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

e. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SHEET METAL MATERIALS

a. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

b. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

c. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

d. Factory- or Shop-Applied Antimicrobial Coating:

   1) Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.

   2) Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

   3) Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.

   4) Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

   5) Shop-Applied Coating Color: Black.

   6) Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.

e. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

   1) Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

f. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 SEALANT AND GASKETS

a. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

b. Two-Part Tape Sealing System:

1) Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2) Tape Width: 6 inches.

3) Sealant: Modified styrene acrylic.

4) Water resistant.

5) Mold and mildew resistant.

6) Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7) Service: Indoor and outdoor.

8) Service Temperature: Minus 40 to plus 200 deg F.

9) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

c. Water-Based Joint and Seam Sealant:

1) Application Method: Brush on.

2) Solids Content: Minimum 65 percent.

3) Shore A Hardness: Minimum 20.

4) Water resistant.

5) Mold and mildew resistant.

6) VOC: Maximum 75 g/L (less water).

7) Maximum Static-Pressure Class: 10-inch wg, positive and negative.

8) Service: Indoor or outdoor.

9) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

d. Solvent-Based Joint and Seam Sealant:

1) Application Method: Brush on.

2) Base: Synthetic rubber resin.

3) Solvent: Toluene and heptane.

4) Solids Content: Minimum 60 percent.

5) Shore A Hardness: Minimum 60.

6) Water resistant.

7) Mold and mildew resistant.

8) VOC: Maximum 395 g/L.

9) Maximum Static-Pressure Class: 10-inch wg, positive or negative.

10) Service: Indoor or outdoor.

11) Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

e. Flanged Joint Sealant: Comply with ASTM C 920.

1) General: Single-component, acid-curing, silicone, elastomeric.

2) Type: S.

3) Grade: NS.

4) Class: 25.

5) Use: O.

f. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

g. Round Duct Joint O-Ring Seals:

1) Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.

2) EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3) Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.4 HANGERS AND SUPPORTS

a. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

b. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

c. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

d. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

e. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

f. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

g. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

h. Trapeze and Riser Supports:

1) Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

2) Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

3) Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.5 SEISMIC-RESTRAINT DEVICES

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.

2) Ductmate Industries, Inc.

3) Hilti Corp.

4) Kinetics Noise Control.

5) Loos & Co.; Cableware Division.

6) Mason Industries.

7) TOLCO; a brand of NIBCO INC.

8) Unistrut Corporation; Tyco International, Ltd.

9) Or Equal.

b. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1) Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

c. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

d. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

e. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.

f. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 EXECUTION

3.1 DUCT INSTALLATION

a. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

b. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

c. Install round ducts in maximum practical lengths.

d. Install ducts with fewest possible joints.

e. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

f. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

g. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

h. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

i. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

j. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

k. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

l. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "Duct Cleanliness for New Construction Guidelines."

3.2 SEAM AND JOINT SEALING

a. Seal duct seams and joints for duct static-pressure and leakage classes specified in "Performance Requirements" Article, according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements," unless otherwise indicated.

1) For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

a) Systems for residential occupancy.

b) Ducts that are located directly in zones they serve.

b. Seal Classes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 1-2, "Standard Duct Sealing Requirements."

1) For static-pressure classes 1- and 1/2-inch wg, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Seal Class C, except as follows:

a) Systems for residential occupancy.

b) Ducts that are located directly in zones they serve.

3.3 HANGER AND SUPPORT INSTALLATION

a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

b. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1) Where practical, install concrete inserts before placing concrete.

2) Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3) Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.

4) Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

5) Do not use powder-actuated concrete fasteners for seismic restraints.

c. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

d. Hangers Exposed to View: Threaded rod and angle or channel supports.

e. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

f. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

a. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1) Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

2) Brace a change of direction longer than 12 feet.

b. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

c. Install cables so they do not bend across edges of adjacent equipment or building structure.

d. Install cable restraints on ducts that are suspended with vibration isolators.

e. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

f. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

g. Drilling for and Setting Anchors:

1) Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2) Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3) Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4) Set anchors to manufacturer's recommended torque, using a torque wrench.

5) Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.5 CONNECTIONS

a. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

b. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

a. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 09 painting Sections.

3.7 FIELD QUALITY CONTROL

a. Perform tests and inspections.

b. Leakage Tests:

1) Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."

2) Test the following systems:

a) Exhaust air.

3) Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.

4) Test for leaks before insulation application.

5) Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

c. Duct System Cleanliness Tests:

1) Visually inspect duct system to ensure that no visible contaminants are present.

2) Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

d. Duct system will be considered defective if it does not pass tests and inspections.

e. Prepare test and inspection reports.

3.8 DUCT CLEANING

a. Clean new and existing duct system(s) before testing, adjusting, and balancing.

b. Use service openings for entry and inspection.

1) Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.

2) Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3) Remove and reinstall ceiling to gain access during the cleaning process.

c. Particulate Collection and Odor Control:

1) When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.

2) When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

d. Clean the following components by removing surface contaminants and deposits:

1) Air outlets and inlets (registers, grilles, and diffusers).

2) Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3) Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.

4) Coils and related components.

5) Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.

6) Supply-air ducts, dampers, actuators, and turning vanes.

7) Dedicated exhaust and ventilation components and makeup air systems.

e. Mechanical Cleaning Methodology:

1) Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.

2) Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.

3) Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

4) Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

5) Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.

6) Provide drainage and cleanup for wash-down procedures.

7) Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 DUCT SCHEDULE

a. Fabricate ducts with galvanized sheet steel except as follows:

1) Moist Environment Ducts: Aluminum.

b. Intermediate Reinforcement:

1) Galvanized-Steel Ducts: Galvanized steel.

2) Stainless-Steel Ducts: Galvanized steel.

3) Aluminum Ducts: Aluminum or galvanized sheet steel coated with zinc chromate.

c. Elbow Configuration:

1) Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

a) Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.

2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.

b) Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.

d. Branch Configuration:

1) Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

a) Velocity 1000 fpm or Lower: 90-degree tap.

b) Velocity 1000 to 1500 fpm: Conical tap.

c) Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

a. Section Includes:

1) Backdraft dampers (factory installed with exhaust fan).

2) Flange connectors.

3) Duct accessory hardware.

b. Related Sections:

1) Division 23 Section "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

1.3 SUBMITTALS

a. Product Data: For each type of product indicated.

1) For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

b. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1) Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a) Special fittings.

b) Wiring Diagrams: For power, signal, and control wiring.

c. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

d. Source quality-control reports.

e. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.4 QUALITY ASSURANCE

a. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

b. Comply with AMCA 500-D testing for damper rating.

PART 2 PRODUCTS

2.1 MATERIALS

a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

b. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

c. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

d. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

e. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 BACKDRAFT AND PRESSURE RELIEF DAMPERS

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Broan

2) Greenheck Fan Corporation.

3) Loren Cook.

4) Or Equal

b. Description: Factory installed with ceiling exhaust fan..

2.3 DUCT-MOUNTED ACCESS DOORS

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) American Warming and Ventilating; a division of Mestek, Inc.

2) Cesco Products; a division of Mestek, Inc.

3) Ductmate Industries, Inc.

4) Flexmaster U.S.A., Inc.

5) Greenheck Fan Corporation.

6) McGill AirFlow LLC.

7) Nailor Industries Inc.

8) Pottorff; a division of PCI Industries, Inc.

9) Ventfabrics, Inc.

10) Ward Industries, Inc.; a division of Hart & Cooley, Inc.

11) Or Equal

b. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1) Door:

a) Double wall, rectangular.

b) Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

c) Vision panel.

d) Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.

e) Fabricate doors airtight and suitable for duct pressure class.

2) Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

3) Number of Hinges and Locks:

a) Access Doors Less Than 12 Inches Square: No hinges and two sash locks.

b) Access Doors up to 18 Inches Square: Two hinges and two sash locks.

c) Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.

d) Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

c. Pressure Relief Access Door:

1) Door and Frame Material: Galvanized sheet steel.

2) Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.

3) Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.

4) Factory set at 10-inch wg.

5) Doors close when pressures are within set-point range.

6) Hinge: Continuous piano.

7) Latches: Cam.

8) Seal: Neoprene or foam rubber.

9) Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.4 DUCT ACCESS PANEL ASSEMBLIES

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Ductmate Industries, Inc.

2) Flame Gard, Inc.

3) 3M.

4) Or Equal.

b. Labeled according to UL 1978 by an NRTL.

c. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

d. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

e. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

f. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.5 FLEXIBLE CONNECTORS

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Ductmate Industries, Inc.

2) Duro Dyne Inc.

3) Ventfabrics, Inc.

4) Ward Industries, Inc.; a division of Hart & Cooley, Inc.

5) Or Equal.

b. Materials: Flame-retardant or noncombustible fabrics.

c. Coatings and Adhesives: Comply with UL 181, Class 1.

d. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

e. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1) Minimum Weight: 26 oz./sq. yd..

2) Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.

3) Service Temperature: Minus 40 to plus 200 deg F.

f. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1) Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.

2) Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.

3) Minimum Additional Travel: 50 percent of the required deflection at rated load.

4) Lateral Stiffness: More than 80 percent of rated vertical stiffness.

5) Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6) Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7) Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.6 DUCT ACCESSORY HARDWARE

a. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

b. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.1 INSTALLATION

a. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

b. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

c. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

d. Set dampers to fully open position before testing, adjusting, and balancing.

e. Install test holes at fan inlets and outlets and elsewhere as indicated.

f. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1) On both sides of duct coils.

2) Downstream from manual volume dampers, control dampers, and equipment.

3) Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

4) At each change in direction and at maximum 50-foot spacing.

5) Upstream of turning vanes.

6) Elsewhere as indicated.

g. Install access doors with swing against duct static pressure.

h. Access Door Sizes:

1) One-Hand or Inspection Access: 8 by 5 inches.

2) Two-Hand Access: 12 by 6 inches.

3) Head and Hand Access: 18 by 10 inches.

4) Head and Shoulders Access: 21 by 14 inches.

5) Body Access: 25 by 14 inches.

6) Body plus Ladder Access: 25 by 17 inches.

i. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

j. Install flexible connectors to connect ducts to equipment.

k. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

l. Install duct test holes where required for testing and balancing purposes.

m. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

a. Tests and Inspections:

1) Operate dampers to verify full range of movement.

2) Inspect locations of access doors and verify that purpose of access door can be performed.

3) Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.

4) Inspect turning vanes for proper and secure installation.

5) Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26. It expands and supplements the requirements specified in sections of Division 01.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Section 09 90 00 - Painting and Coating.

3. Section 31 23 00 - Excavating, backfilling and compacting for utilities.

4. Division 23 - HVAC.

5. Division 27 – Communications.

C. Applicable Standards

1. ASTM D 709 (2007) – Laminated Thermosetting materials.

2. ANSI/NEMA FB-1 (2010) – Standard for Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.

3. ANSI/NEMA 250 (2008) – Enclosure for Electrical Equipment (1000 Volts Maximum).

4. California Electrical Code (CEC).

5. IEEE C57.12.28 (2005) – Standard for Pad-Mounted equipment (Enclosure Integrity).

6. UL 1 (2005) – Standard for Flexible Metal Conduit.

7. UL 1242 (2007) – Standard for Electrical Intermediate Metal Conduit.

8. UL 506 (2008) – Specialty Transformers.

9. UL 6 (2010) – Electrical Rigid Metal Conduit-Steel.

10. UL 797 (2007) – Electrical Metallic Tubing-Steel.

11. UL 870 (2008) – Standard for Wireways, Auxiliary Gutters, and Associated Fittings

1.2 BASIC ELECTRICAL REQUIREMENTS

A. DESCRIPTION

a) Provide all labor materials and equipment necessary for general electrical requirements where shown on the contract drawings and specified herein.

b) Included Work:

1. Provide all labor, materials, equipment, tools and appliances required to furnish and install all electrical work as shown on the Contract Drawing and the specifications. All systems must be constructed complete and operable. The scope includes but not limited to the following:

   a. All construction power and lighting and power for testing equipment and systems through final acceptance of test.

   b. Power, low voltage and lighting raceway(s) underground inside the property line boundaries.

   c. All underground power and low voltage conduits on and off site per the utility company's requirements, plans and provisions.

2. Complete lighting and power system(s) including branch circuits, fixtures, outlets, lamps, switches, controllers, and auxiliary equipment.

3. Complete distribution system(s) including switchboards, panel boards, transformers, feeders, and auxiliary equipment.

4. Complete system of exterior (vandal resistant) lighting.

5. Complete Grounding System.

6. Complete Alerting System(s), including service raceways, cabinets, backboards, grounding, AC power provisions, etc. Contractor shall coordinate with USDD, Owner's instructions for the placement of devices.

7. Fire department Communication tower and all related raceways, cable trays, etc.

8. Television antenna and coaxial cable distribution system.

9. Complete Data, phone and TV distribution system with all raceways and wiring. All systems to be functional and tested.

10. Distribution for emergency power system including but not limited to lighting panel boards and all branch circuit wiring.

11. All control wiring and devices for equipment specified in Sections of Division 26 and other technical Sections, except where specifically indicated or noted otherwise on the Contract Drawings or in the Specifications.

12. Complete, operable and certified fire alarm system.

13. All testing for all installed systems including all owner furnished items.

14. Applicable excavating, trenching and backfilling.

B. Quality Assurance:

1. Workers possessing the skills and experience obtained in performing work of similar scope and complexity shall perform the Work of this Division.

2. Refer to other sections of the Specifications for other qualification requirements.

C. Drawings and Specifications Coordination:

1. For purposes of clearness and legibility, Drawings are essentially diagrammatic and the size and location of equipment is indicated to scale whenever possible. Verify conditions, dimensions, indicated equipment sizes, and manufacturer's data and information as necessary to install the Work of this Division. Coordinate location and layout with other Work.

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

3. Drawings indicate required size and points of termination of conduits, number and size of conductors, and diagrammatic routing of conduit. Install conduits with minimum number of bends to conform to structure, avoid obstructions, preserve headroom, keep openings and passageways clear, and comply with applicable code requirements.

4. Routing of conduits may be changed provided that the length of any conduit run is not increased more than 10 percent of length indicated on the Drawings.

5. Outlet locations shall be coordinated with architectural elements prior to start of construction. Locations indicated on the Drawings may be distorted for clarity.

6. Coordinate electrical equipment and materials installation with building components and the Work of other trades

7. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

8. Coordinate connection of electrical systems with existing underground utilities and services.

D. Terminology:

1. Signal Systems: Applies to clock, bell, fire alarm, annunciator, sound, public address, buzzer, telephone, television, inter-communication, elevator access controls, lighting control systems and security systems.

2. Low Voltage: Applies to signal systems operating at 120 volts and less, and power systems operating at less than 600 volts. Medium voltage: Applies to power systems operating at more than 600 volts.

3. UL: Underwriter's Laboratories Inc, Nationally Recognized Testing Laboratory (NRTL), or equal.

E. Regulations: Work shall comply with the requirements of authorities having jurisdiction and the California Electrical and Building Codes. Material shall conform to regulations of the National Board of Fire Underwriters for electrical wiring and apparatus. Materials shall be new and listed by UL, or another NRTL.

F. Structural Considerations for Conduit Routing:

1. Where conduits pass through or interfere with any structural member, or where notching, boring or cutting of the structure is necessary, or where special openings are required through walls, floors, footings, or other buildings elements, conform to CBC, Part 2, Title 24, Section 1906.3 for conduits and pipes embedded in concrete and Sections 2308.9.10 and 2308.9.11 for notches and bored holes in wood; for steel, as detailed on the structural steel Shop Drawings.

2. Where a concrete encasement for underground conduit abuts a foundation wall or underground structure which the conduits enter, encasement shall rest on a haunch integral with wall or structure, or shall extend down to footing projection, if any, or shall be doweled into structure unless otherwise indicated. Underground structures shall include maintenance holes; pull boxes, vaults, and buildings.

3. Holes required for conduit entrances into speaker poles, floodlight poles or other poles, shall be drilled with the conduit nipple or coupling welded to poles. Welds shall be provided by the electric arc process and shall be continuous around nipple or coupling.

G. Electrically Operated Equipment and Appliances:

1. Furnished Equipment and Appliances:

a. Work shall include furnishing and installing wiring enclosures for, and the complete connection of electrically operated equipment and appliances and electrical control devices which are specified to be furnished and installed in this or other sections of the Specifications, wiring enclosures shall be concealed except where exposed Work is indicated on the Drawings.

b. Connections shall be provided as necessary to install equipment ready for use. Equipment shall be tested for proper operation and, if motorized, for proper rotation. If outlets are of incorrect electrical characteristics or any specified equipment fails to operate properly, repair and/or replace the outlet and/or equipment.

2. Equipment and Appliances Furnished by Others:

a. Equipment and appliances indicated on Drawings as "not in contract" (NIC), "furnished by others," or "furnished by the Owner," will be delivered to the Project site. Required electrical connections shall be performed for such equipment and appliances. Motorized equipment will be furnished factory-wired to a control panel or junction box unless otherwise indicated. Appliances will be furnished equipped with portable cord and cap. Provide disconnect switches where required.

b. Connections to equipment furnished under this Division shall be part of the Work of this section. Work shall include internal wiring, installation, connection and adjustment of bolted drive motors in which the motor is supplied as a separate unit, and connections only for equipment furnished with factory installed internal wiring, except as further limited by Drawings and this Specification. Work shall include furnishing and installing suitable outlets, disconnecting devices, starters, push-button stations, selector switches, conduit, junction boxes, and wiring necessary for a complete electrical installation. Work shall also include furnishing and installing conduit and boxes for HVAC control systems, furnished under Division 23. Devices and equipment furnished shall be of same type used elsewhere on the Work or as specified.

c. Electrical equipment furnished under other sections, for installation and connection under Work of this section, will be delivered to the Project site ready for installation.

d. Mechanical equipment furnished under other sections, and requiring electrical connection under this section, will be set in place as part of the Work of the section furnishing such equipment unless noted otherwise.

e. Suitability and condition of equipment furnished under other sections shall be determined in advance of installation. Immediate notice of damage, unsuitability, or lack of parts shall be given to the entity providing such equipment.

H. Submittals:

1. Conform to applicable provisions of Division I of the General Requirements and as hereinafter specified.

2. Prepare, review and coordinate schedule of submittals, determining necessary lead time for preparation, submitting, checking, and ordering and delivering materials and equipment to the job-site for timely arrival and conformance with the overall Construction schedule.

3. All submittals will be checked for general compliance with Specifications only. Contractor will be responsible for deviations from the Drawings or Specifications and for errors or omissions of any sort in the Submittals.

4. All required submittals on electrical items and equipment shall include complete catalog information such as construction ratings. insulation systems, including manufacturer's certification that items or equipment meet or exceed and Trade Standards, and the Specifications. All items must be U.L. listed or listed per a recognized by code listing agency.

5. Equipment Floor Plans: Submit after approval of material and/or equipment is secured. Prepare for each electrical equipment room drawn to 2" = 1'-0" scale. Layout drawing shall be to exact scale.

6. Materials list of items and equipment proposed to be provided for the work of this Division and shall include at least the following as applicable:

   a. Service and distribution switchboard.

   b. Emergency generator set.

   c. Lighting panel boards.

   d. Lighting control panels.

   e. Conduits.

   f. Conductors.

   g. Electrical equipment layout at scale indicating on drawings of equipment,

   h. Clearances, housekeeping pads.

   i. Disconnect switches, pull boxes and fuses.

   j. Lighting fixtures.

   k. Fire alarm and detection system.

   l. Control devices, standard and special receptacles, switches and finish device plates.

   m. Cabinets for signal and telephone systems, special terminals and cabinets.

n. Vibration isolators, including lateral and vertical seismic restraints.

o. All fabricated equipment.

p. Time clocks, contactors, control switches, etc. including wiring diagrams and sequence of operation.

7. Short Circuit, Arc flash and Coordination Study.

a. Submit, along with switchgear and distribution equipment submittal, system short circuit study based on the per unit method or in accordance with the latest IEEE recommendations, Report to be submitted with the shop drawings of the main service and the distribution system, each copy bound with a stiff cover.

b. Provide Arc flash calculations and provide a sticker with the value and the recommended protective gear.

c. Submit, along with the short circuit study, a coordination study of all protective devices, including the utility company protective device through all feeder devices on the secondary of each transformer downstream to each panel board and motor control center. Settings shall be incorporated with the coordination study. Study both short circuit and coordination studies~ comprising the power systems study shall be signed by California Registered Electrical Engineer who shall determine the adjustable settings for protective devices. All switchgear and distribution equipment shall comply with the results and recommendations of the studies. The ampere interrupting capacity (A.I.C.) rating of devices shall be a minimum of at least ten percent greater than the calculated value of symmetrical three-phase fault current at that respective device. All circuit breakers shall be fully rated. Series rated breakers shall not be accepted. Feeder lengths and materials shall be determined independently by the installing contractor, and documented in the study. Studies shall include entire system from normal utility source, emergency source down to panel boards, and individual feeder loads serving specific equipment.

d. Studies to be done by switchgear manufacturer and shall include a tabular form indicating calculated fault value, the A.I.C. value and the available arc flash energy and the recommended protective gear at each equipment.

8. Special Submissions:

I. Test Reports for the following:

a. Ground fault devices.

b. Megger Readings: Ground system, motors, feeders and switchgear.

c. Voltage Readings: Distribution, service and motors.

d. Fire alarm system.

I. Protection of Materials:

1. Protect materials and equipment from damage and provide adequate and proper storage facilities during progress of the Work. Damaged materials and/or equipment shall be replaced.

J. Cleaning:

1. Exposed parts of Work shall be left in a neat, clean, usable condition. Finished painted surfaces shall be unblemished and metal surfaces shall be polished.

2. Thoroughly clean parts of apparatus and equipment. Exposed parts to be painted shall be thoroughly cleaned of cement, plaster, and other materials. Remove grease and oil spots with solvent. Such surfaces shall be wiped and corners and cracks scraped out. Exposed rough metal shall be smooth, free of sharp edges, carefully steel brushed to remove rust and other spots, and left in proper condition to receive finish painting.

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

K. WARRANTIES

1. Provide one year warranty on all material and labor performed as a minimum, unless noted otherwise in specific sections.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Advise the Inspector before starting the Work of this Division.

B. Exposed conduits shall be painted to match the surfaces adjacent to installation.

C. Salvaged materials removed from buildings shall be removed from the Project site as required by the OAR.

D. Trenches outside of barricade limits shall be backfilled and paved within 24 hours after being inspected by the Inspector. Provide traffic plates during the time that trenches are open in traffic areas and in areas accessible to students and staff.

E. Where existing structural walls are cored for new conduit runs, separation between cored holes shall be three inches edge to edge from new or existing holes, unless otherwise required by the Architect. All coring to be laid out and reviewed by Architect prior to drilling. Contractor to verify location of structural steel, rebar, stress cabling or similar prior to lay out.

F. Electrical equipment shall be braced and anchored for CBC Seismic Design requirements, or as otherwise indicated on the Drawings.

G. LEGAL REQUIREMENTS AND STANDARDS

a. Required: Comply with the latest, as applicable and effective, during the progress of Contracted Work.

1. Latest Ventura County, Electrical, Fire and Building Codes and Supplemental addendums and requirements.

2. California State Administrative Code, Title 24, State Building Standard.

3. (CAUOSHA) California State Occupational Safety and Health Act.

4. California State Fire Marshal Standards.

5. Southern California Edison.

6. U.L. - Underwriters Laboratories Inc.

7. NEC - National Electric Code.

8. ASTM - American Society of Testing and Materials.

9. Current publications of the National Fire Protection Association.

10. National and American Standards Association.

b. General compliance as applicable

1. Drawings and specification requirements shall govern where they exceed Code requirements, in case of a conflict between the plans, the codes and the specifications, the more stringent shall apply.

2. Where requirements between governing Codes and Regulations vary, the more restrictive provision shall apply.

3. Nothing contained in Contract Documents shall be construed as authority or permission to disregard or violate legal requirements.

3.2 DELIVERY STORAGE AND HANDLING

A. Deliver products to project site with proper identification, which shall include names, model numbers, types, grades, compliance labels, and similar information needed for District identification; all products and materials shall be adequately packaged and protected to prevent damage during shipment, storage, and handling.

B. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion.

3.3 CUTTING AND PATCHING

A. Cutting and patching of electrical equipment, components, and materials shall include the removal and legal disposal of selected materials, components, and equipment.

B. Do not endanger or damage installed Work through procedures and processes of cutting and patching.

C. Repair or restore other work, or surfaces damaged as a result of the work performed under this contract.

3.4 PRELIMINARY OPERATIONS

A. Required; Should the District require that any portion of the systems or equipment be operated prior to the final scheduled dates for completion and acceptance of the work, the Contractor shall consent. Such operation shall be under the direct supervision of, and at the expense of the Contractor, and shall not be construed as an acceptance of any of the work by the District.

3.5 CLEANUP

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

C. Remove equipment and implements of service, and leave entire work area neat and clean, to the satisfaction of the Owner Authorized Representative.

3.6 PROTECTION

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

3.7 COMPLETION

A. Protect The work will not be reviewed for final acceptance until operating and maintenance data, manufacturer's literature, panel directories and nameplates specified herein have been approved and properly posted or installed and final cleaning of equipment and premises has been completed.

B. When the installation is complete and all adjustments have been made, operate the systems for a period of one week, during which time demonstrate to the Engineer that the systems are completed and operating in conformance with the Specifications.

END OF SECTION

SECTION 26 05 13

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Boxes, enclosures, keys and locks.

2. Receptacles and switches.

3. Identifications and signs.

B. Related Requirements:

1. Division 01 - General Requirements.

2. Division 26 – Electrical.

3. Division 27 – Communications.

4. Division 28 - Electronic Safety and Security.

PART 2 - PRODUCTS

2.1 BOXES, ENCLOSURES, KEYS AND LOCKS

A. Outlet Boxes and Fittings:

1. Outlet boxes installed in concealed Work shall be galvanized steel, pressed, or welded type, with knockouts.

2. In exposed Work, where conduit runs change direction or size, outlet boxes and conduit fittings shall be cast metal with threaded hubs cast integral with box or fitting.

3. Fittings shall be cast metal and non-corrosive. Ferrous metal fittings shall be cadmium-plated or zinc galvanized. Castings shall be true to pattern, smooth, straight, with even edges and corners, of uniform thickness of metal, and shall be free of cracks, gas holes, flaws, excessive shrinkage, and burnt-out sand.

4. Covers for fittings shall be galvanized steel or non-corrosive aluminum and shall be designed for particular fitting installed.

5. Light fixture outlets shall be 4-inch octagon, 4-inch square, 2 1/8-inch deep or larger, depending upon number of conductors or conduits therein. Plaster rings shall be furnished with round opening with two ears drilled 2 23/32 inches center to center.

6. For local device outlets provide 4-inch square 2 1/8-inch deep, boxes for single gang, 5-inch square boxes for two-gang, and special solid gang boxes with gang plaster ring for more than two switches.

7. For TV outlets, and horns and strobes provide manufacturer's supplied back box as needed. For television outlets, provide 4-gang deep boxes and 4-gang plaster rings.

8. Plaster rings shall be provided on flush-mounted outlet boxes except where otherwise indicated or specified. Plaster rings shall be same depth as finished surface. Install approved ring extension to obtain depth to finish surface.

9. In existing plywood wall or drywall construction, and where flexible steel conduit is fished into walls, single-gang and 2-gang outlets for wiring devices may be sectional steel boxes with plaster ears. Boxes shall be fastened to plywood with flat-head screws in each plaster ear screw hole. Boxes fastened to gypsum board shall be Raco, Appleton, Cooper, Bowers, or equal.

10. Factory made knockout seals shall be installed to seal box knockouts, which are not intact.

11. Where flexible conduit is extended from flush outlet boxes, provide and install weatherproof universal box extension adapters.

B. Junction and Pull boxes:

1. Junction and pull boxes, in addition to those indicated, shall only be used in compliance with codes, recognized standards, and Contract Documents.

2. Interior and non-weatherproof boxes shall be constructed of blue or galvanized steel with ample laps, spot welded, and shall be rigid under torsion and deflecting forces. Boxes shall be furnished with auxiliary angle iron framing where necessary to ensure rigidity.

3. Covers shall be fastened to box with a sufficient number of machine screws to ensure continuous contact all around. Flush type boxes shall be drilled and tapped for cover screws if boxes are not installed plumb. Surfaces of pull and junction boxes and covers shall be labeled in black marker ink designating system, panelboard and circuit designation contained in box. In exposed Work, designation shall be installed on inside of pullbox or junction box cover.

4. Weatherproof NEMA 3R pull and junction boxes shall conform to foregoing for interior boxes with following modifications:

   a. Cover of flush mounting boxes shall be furnished with a weather-tight gasket cemented to, and trimmed even with, cover all around.

   b. Surface or semi-flush mounting pull and junction boxes shall be UL, or another Nationally Recognized Testing Laboratory (NRTL) listed as rain-tight and shall be furnished complete with threaded conduit hubs.

c. Exposed portions of boxes shall be galvanized and finished with one prime coat and one coat of baked-on gray enamel, unless already furnished with factory baked-on finish.

5. Junction and pull boxes shall be rigidly fastened to structure and shall not depend on conduits for support.

6. Underground Concrete Pull Boxes:

a. Pre-cast concrete pull boxes. Concrete pull boxes shall be traffic type, reinforced for H-20 wheel loading, pre-cast concrete. Pull boxes with inside dimensions of 2 feet by 3 feet by 3 feet deep shall consist of a base section, top ring, and cover. Base section shall be furnished with 2 knockouts measuring 10 inch by 10 inch in each 3 feet side, and one 20 inch by 20 inch knockout in each 2-foot side. Pull boxes with inside dimension 4 feet by 4 feet by 4 feet deep shall consist of a base section, midsection, topping, and cover. Base section shall be furnished with 2 knockouts measuring 8-inch by 16-inch on each of two opposite sides, and one 20-inch by 20-inch knockout on each of other two opposite sides. Pull boxes shall be furnished with a minimum of 6-inch diameter sump knockout and one inch diameter ground rod knockout. In pull boxes, furnish and install cable racks on walls. Racks shall be furnished with 3 porcelain cable holders on vertical steel mounting bars. Pull boxes shall be furnished with 3/4 inch diameter pull irons. Covers shall be traffic-type consisting of steel safety plate bolted to frame. Covers shall be marked as electrical, power, or signal as required. Pull boxes shall be as manufactured by Oldcastle Precast, Jensen Precast, Kistner, Western Precast, or equal.

b. Provide end bells in duct entrances. Terminate each metal conduit with insulated bushing provided with a grounding terminal.

c. Install pulling irons on opposite walls and below horizontal centerlines of ducts and bricked-up openings, and in bottom. Install pulling irons with each end hooked around a reinforcing bar.

d. Remove floor drain knockout and provide a depth of 24 inches of crushed rock below box extending a minimum of 12 inches beyond on all sides.

e. Permanently and effectively ground metal equipment cases, cable racks, and similar items in pull boxes to site grounding electrode system. Provide grounding conductor in compliance with CEC Article 250.

f. Provide 6-inch deep sand base under pull boxes.

g. Identify power and signal cables by tagging in manholes and pull boxes. Tie securely to cables with nylon cord.

h. Top of steel plate shall provide a minimum coefficient of static friction of 0.5 for either wet or dry locations, when tested for any shoe sole material. Test shall comply with ASTM D 1047 or F 489 or F 609 standards. Submit manufacturer's test results for Architect's review as part of materials and equipment submittals.

i. The use of underground extension boxes shall be limited to not more than 1 times the original depth of pull box.

7. Underground utility boxes shall be reinforced concrete with non-setting shoulders to prevent settlement following installation. Boxes shall be furnished with cast iron cover with finger hole, size as indicated on Drawings. Utility boxes shall be as manufactured by Oldcastle,Jensen, Kistner, Western Precast, or equal.

8. Manholes, vaults, and pull boxes required by a utility company, and installed as part of this Contract, shall meet requirements of servicing utility company.

C. Floor Outlets:

1. Provided floor outlets, except for extension outlets, shall be Harvey Hubbell Inc. B-2503, Thomas & Betts 640 series, Legrand Omnibox, or equal, adjustable, cast iron, watertight floor boxes with flush brass floor plates, and shall be set to finish flush with finish floor covering, whether it be carpeted, wood, resilient floor covering, or other finish materials. Floor boxes shall be used in office, classrooms, and in library areas only.

2. Telephones above floor outlets, where not subjected to water, shall be provided with Harvey Hubbell Inc. SC-3098 pedestals with SC309T plates, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms and in Library areas only.

3. Plugs above floor outlets where not subjected to water shall be provided with Legrand 525 series, Thomas & Betts FPT-400 Series, Harvey Hubbell Inc. SC-3098, or equal, pedestal and with SS309D, or equal, device plates. Refer to other Division 26 sections. Floor boxes shall be used in office, classrooms, and library areas only.

4. Plugs above floor outlets where subjected to water shall be provided with a Harvey Hubbell Inc. SA-6685 or equal, single-gang outlet box, or SA-6687 or equal, 2-gang outlet box. Provide required cover plate. Refer to other Division 26 sections. Floor outlets shall be used in Cafeteria, Cafeteria serving areas, or any areas where floors are subjected to water.

5. Furnished extension floor outlets shall be cast iron floor boxes with cast iron covers and 1/2 inch offset entries for above-floor conduit extensions; Harvey Hubbell F3186, or equal. Boxes shall be designed to permit access to wiring without disturbing above-floor extensions and shall be set flush with finish floor.

6. Furnished above floor service fittings for surge suppression receptacles shall be Hubbell SC3098 with cover plates SS309DS, Legrand 525 series, Thomas & Betts FPT-400 Series, or equal.

7. Furnished above floor service fittings for data outlets shall be Hubbell SC3098 with required cover plates, Legrand 525 Series, Thomas & Betts FPT-400 Series, or equal. Refer to other Division 26 sections.

D. Floor Pockets:

1. Three-Gang: Furnished three-gang floor lighting pockets shall be flush floor type, with cast iron floor plate and hinged cast iron door notched for cables. Three-gang floor pockets shall be owner approved Legrand or Hubbell Recessed Floor Boxes, C.W. Cole TLS-353-6, or equal, for wood floors and C.W. Cole TLS-353-6-C, or equal, for concrete slabs. Each floor pocket shall be provided with three 20 amp, 3 wire, 125 volt receptacles with matching caps.

2. Single Gang:

a. Receptacle floor pockets shall be single gang, flush floor type, with cast iron floor plate, hinged cast iron door notched for cable and cast iron box; C.W. Cole TLA-362-1-FE, or Owner approved Legrand or Hubbell recessed floor box or equal. Provide each pocket with a standard, single grounding type receptacle unless otherwise indicated. Provide C.W. Cole TLS-362-1, or equal, in wood floors.

b. Microphone or projector floor pockets shall be single gang flush floor type with cast iron floor plate, hinged cast iron door, notched for cable and cast iron box, or owner approved Legrand or Hubbell recessed floor box, C.W. Cole TLA-362-3-FE, C.W. Cole TLS-362-3,in wood floors, or equal.

E. Keys and Locks:

1. Provide two keys with furnished door locks, including cabinet door locks and switchboard locks, two keys for lock switches on switchboards or control panels, and two keys with interlocks or other furnished lock switches. Deliver keys to Owner.

2. Locks shall be keyed to Corbin No. 60 keys for access to operate equipment and Corbin 70 keys for service access. Special keys and locks shall only be provided where specified.

2.2 RECEPTACLES AND SWITCHES

A. Wireless Controlled Receptacles:

1. The Duplex Controller shall be the Echoflex ERNR Series Split Duplex Controller by Echoflex Solutions, Inc., or equal. (Compatible with the Occupancy sensor Echoflex MOS-21U Series Occupancy Sensor by Echoflex Solutions, Inc., or equal).

1. Mechanical

a. The Controller shall mount in a standard single-gang wall box

b. The Controller shall have learn and clear buttons for manual linking of switches and sensors

1) The buttons shall be accessible when the Controller is mounted, prior to mounting the faceplate.

c. The Controller shall have two LED indicators to display power and linked device information

d. The Controller shall have LED arrows pointing to controlled side of receptacle so that controlled side is permanently marked and easily visible in dark locations

e. The Controller shall have an embossed icon ⏻ so that the controlled side is permanently marked

2. Electrical

   a. The Controller shall support 120VAC power input

   b. The Controller shall provide a single normally open relay contact, fully rated for 15 amps to switch power to the controlled receptacle

      1) The Controller shall have an auxiliary output controlled from the internal relay for wiring directly to other duplex receptacles

   c. The Controller shall use a 902 MHz EnOcean radio. Systems that use other radio frequencies shall not be acceptable

   d. The internal radio shall have a range of at least 80 feet through walls (laterally), up to 300 feet in open space

   e. The Controller shall be ETL listed, conform to UL 508, and certified to CAN/CSA Standard C22.2 No.14

   f. The Controller shall comply with FCC Part 15.231 and IC RSS-210

3. Functional

   a. The Controller shall provide switching control for an individual load plugged into the controlled receptacle

   a. The Controller shall support wireless Echoflex switches and sensors for relay control

      1) The Controller shall support linking of at least 20 wireless devices in any combination of Echoflex stations and sensors. Systems that do not support at least 20 stations or sensors shall not be acceptable

   b. The Controller shall provide the option of single or dual-hop wireless signal repeating to other controllers. Systems that do not provide signal repeating shall not be acceptable

   c. The Controller shall support Central Command functions for use with integrated control systems

   d. The Controller shall support commissioning and linking through software and/or mechanical means. Controllers that do not support both shall not be acceptable

   e. The Controller shall provide configuration variables that allow customization of the controllers operation with linked sensors and switches

   f. The Controller shall provide the option of reporting relay status wirelessly

   g. The Controller shall save all configuration settings and linked device details in non-volatile memory

      1) The Controller shall provide the option of saving user-defined

configuration settings as recoverable default settings

A1. Receptacles:

1. Duplex receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wired with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be PVC. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20	PS5362-I	HBL5362-I	5362-I
(15 amps) NEMA 5-15	PS5262-I	HBL5262-I	5262-I

2. Duplex receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour model number PS5262BL (blue), Hubbell DRUBTVSS15, Leviton 5262-SBU, 15 amps, 120 volts, or equal.

3. Single receptacles shall be heavy-duty specification grade, grounding type. Terminal screws shall be back and side wire with internal screw pressure plates. Mounting strap shall feature heavy-duty brass construction. Receptacle back body shall be thermoplastic. Receptacle face shall be ivory, impact resistant nylon. Receptacles shall have triple wipe brass power contacts. For circuits consisting of one single receptacle only, ampere rating of receptacle shall be same as circuit breaker or fuse.

NEMA #	Pass & Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5361-I	HBL5361-I	5361-I
(15 amps) NEMA 5-15R	5261-I	HBL5261-I	5261-I

4. 15 and 20 amps single receptacles on circuits supplied by panel boards with integral surge suppression shall be Pass & Seymour NEMA 5-20R model number 5361-BL (blue), and NEMA 5-15R model number 5261-BL (blue) respectively. Equal receptacles by other Owner approved manufactures are acceptable.

5. For kiln receptacles and range receptacles, provide 3-pole, 4-wire, grounding type, rated 50 amps at 125/250 volts NEMA 14-50R. Provide with 2-gang, stainless steel plates, SS 703, or equal.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 14-50R	3894	HBL9450A	279
WALL PLATE	SS703	S703	84026

6. For dryer receptacles, provide 3-wire, non-grounding type, rated 30 amps at 125/250 volts, NEMA 10-30R, with 2-gang stainless steel plates. Coordinate location of junction box with the work of Section 10 28 15, Hand and Hair Dryers.

NEMA #	Pass& Seymour	Hubbell	Leviton

NEMA 10-30R	3860	HBL9350	5207
WALL PLATE	SS703	S703	84026

7. Provide specification grade ground-fault circuit interrupter (GFCI) type receptacles in accordance with 2010 UL standards. GFCI receptacles shall have a trip indication light. Receptacle terminal screws shall be back and side wire with internal screw pressure plates. Test and reset buttons shall match device body and shall be ivory. GFCI receptacles shall be manufactured in standard configuration for installation with stainless steel smooth plates. Exterior mounted receptacles shall be mounted inside weatherproof enclosure.

NEMA #	Pass & Seymour	Hubbell	Leviton
NEMA 5-20R	2095-I	GFR5352-IA	7899-I
NEMA 5-15R	1595-I	GFR5252-IA	8598-I

8. Provide weatherproof receptacles, except where otherwise indicated or specified, consisting of GFCI receptacles, as specified herein, and metal plates with die-cast lockable hinged lids and weatherproof mats;

9. Provide transient voltage surge suppression (TVSS) receptacles offering metal oxide varistors (MOVs) protecting normal and common modes, (L-N, L-G, N-G) with 500V suppressed voltage. TVSS devices shall offer 3-mode equal protection with 210 joules minimum per mode of energy absorption and 13,000 amp maximum surge capability. TVSS devices shall have 3 thermal fuses and two over-current protection fuses. TVSS devices shall have LED visual only surge status indicator to alert user to surge suppression circuit condition. Visual indicator will be illuminated (red) when power is on and surge suppression circuit is fully functional. Visual indicator will not be illuminated when power is off or unit experiences loss of surge suppression protection. Terminals shall be back and side wire including ground terminal. Color shall be blue.

NEMA #	Pass& Seymour	Hubbell	Leviton
(20 amps) NEMA 5-20R	5352BLSP	HBL5360SA	5380B
(15 amps) NEMA 5-15R	5252BLSP	HBL5260SA	5280B

10. Receptacles within 6 feet of water fountains, counter tops, or any sources of water shall be GFCI type.

B. Switches:

1. Local Switches:

a. Provide local switches, high strength thermoplastic toggle, specification industrial grade, rated 20 amps at 120-277 volts AC only, with plaster ears, external screw pressure plate back and side wired, and standard size composition cups which fully enclose mechanism. Switches shall be approved for installation at currents up to full rating on resistive, inductive, tungsten filament lamp and fluorescent lamp loads, and for up to 80 percent of rating for motor loads. Switches shall have oversized silver alloy contacts for long

life and better heat dissipation. Provide switches as single pole, double pole, 3-way, 4-way, non-lock type. Provide non-lock type switches with ivory handles;

	Pass & Seymour	Hubbell	Leviton
Single pole	PS20AC1I	HBL1221I	1221-2I
Double pole	PS20AC2I	HBL1222I	1222-2I
Three way	PS20AC3I	HBL1223I	1223-2I
Four way	PS20AC4I	HBL1224I	1224-2I

b. Provide lock type switches, specification industrial grade, 20 amp, 120-277 volts with metal or nylon key guides with on/off indication, and operable by same key. Key shall be Owner standardized vertically oriented, tamper resistant, forked key with two each 5/16-inch long forks, 5/32-inch spacing between forks and 5/16-inch width overall.

	Pass & Seymour	Arrow Hart
Single pole	PS20AC1L w/#500 Key-2L	1221L w/1201LK Key
Double pole	PS20AC2Lw/#500 Key	1222L w/1201LK Key
Three way	PS20AC3L w/#500 Key	1223L w/1201LK Key
Four Way	PS20AC4L w/#500 Key	1224L w/1201LK Key

c. Rotary lock switches shall incorporate a tumbler type lock to prevent unauthorized operation. Lock shall be tumbler type by Corbin, keyed to a HH41 key. Lock switch to be installed with pin tumblers facing downward. Key shall be removable in all positions. Each device shall be complete with 2 keys. Keys shall be delivered only to the Owner. Switches shall be rated at 20 amps, 120-277 volt AC. Switch plates shall be of stainless steel, engraved with on and off positions indicated.

	Arrow Hart
Single pole	AH1191N
Double pole	AH1192N
Three way	AH1193N

d. Pilot light switches shall be rated 20 amps and shall conform to specifications for local switches. Switches shall be furnished with red, Lexan handles that

are lighted by long-lasting neon lamps. Pilot light shall light when load is on. Pilot light 120 volt switches

	Pass& Seymour	Hubbell	Leviton
Single pole	PS20AC1-RPL	HBL1221-PL	1221-PLR
Double pole	PS20AC2-RPL	HBL1222-PL	1222-PLR
Three way	PS20AC3-RPL	HBL1223-PL	1223-PLR

Same as above except rated at 20 amps at 277 volts.

	Pass & Seymour	Leviton	Hubbell
Single pole	PS20AC1-RPL	1221-7PR	HBL1221-PL7

e. Provide remote control switches for mechanically held contactors arranged for 3-wire control, toggle type, momentary contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclose mechanism, and ivory handles

Pass & Seymour	Hubbell	Leviton
1251-I	HBL1557-I	1285-I

f. Provide remote control switches for magnetically held contactors arranged for 3-wire control, toggle type, maintained contact, single pole, 3-position with center off position, rated 20 amps at 120-277 volts AC only, with plaster ears, binding screws for side wiring, standard size composition cups which fully enclosed mechanism, and ivory handles.

Pass and Seymour	Hubbell	Leviton
1225-I	HBL 1385	1285-I

g. Momentary Contact locking key type switch. 20A 120/277V center off. Key shall be Owner standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/32" spacing between forks and 5/16" width overall.

Arrow Hart

AH1995L w/ AH2000 key

h. Momentary Contact switch low voltage 1 pole 3A 24VAC 3 position center off. Key for locking switch shall be Owner standardized vertically oriented, tamper resistant, forked key with two each 5/16" long forks, 5/31" spacing between forks and 5/16" width overall.

Pass and Seymour

Toggle 1081I

Locking 1081KGRY w/#500 Key

2. Time Switches and Photoelectric Controls for existing construction; use section 26 09 23 for new construction.

   a. Provide time switches with a 7-day, solid-state, electronic type capable of fully automatic or manual operation and housed in a sheet steel enclosure unless built into a panel or switchboard. Contacts rated for 25 amps resistive or inductive, each pole 240 VAC; 5 amps tungsten or 277 VAC pilot duty, each pole 240 VAC. Time switches to contain a non-volatile clock and non-volatile memory with a built-in rechargeable super capacitor power carry-over system. Battery carryover is not acceptable. Provide a minimum of 15 on/off set points per week. Timing to be in one minute increments with a minimum on or off time of one minute. Time switch digital displays to indicate days of week, hours, and minutes. Display to contain a load status light to indicate when equipment is in operation. Time switches; Paragon Model EC7000 Series, Tork Model EW 101B series, Intermatic ET7000 series, or equal. Features required for application:.

      1) Liquid crystal display panel.

      2) Holiday scheduling: Up to 40 dates may be assigned special holiday schedules, up to one year in advance.

      3) Automatically adjusts to and from daylight savings time and for leap year.

      4) Contact ratings: 10 amp at 240 VAC.

      5) Safety override switch for each circuit to either provide shut down of circuit or to override on.

      6) Selective review: All or part of schedule shall be displayed at touch of a key.

      7) Super Capacitor for power carry over system.

      8) Supply voltage: 120 V.

      9) 365-day advance scheduling.

   b. Photoelectric control: Shall be rated 2,000 watts, 120V with single pole, single throw, normally closed contact, enclosed in a die-cast aluminum gasketed enclosure with 1/2 inch conduit fitting, Tork series 2100, or equal.

3. Emergency Lighting Control Unit

a. The Emergency Lighting control Unit shall provide all required functionality to allow an standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

b. The emergency lighting control unit shall allow control of emergency lighting fixture in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.

c. The device shall have normally closed dry contacts capable of switching 10 amp emergency ballast loads at 120-277 VAC, 60 Hz, or 2 amp tungsten loads at 120 VAC, 60Hz.

d. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.

e. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency)

f. The device's normal power input terminal shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.

g. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

h. Device shall be WattStopper ELCU-100 Emergency Lighting Control Unit, LVS #EPC-PM Series, Lighting Control Design #GR 2001 series or Equal.

4. Station Main Entrance Intercom Station:

a. Provide Panasonic video intercom system VL-SV30BX (or equal) . locate per plans and install per manufacturer recommendations.

5. Cords and Caps:

A. Manufacturers:

1. Rome Cable Corporation

2. Hubbell

3. Or equal

Attachment Plug Construction to Conform to NEMA WD 1 match receptacle configuration to outlet provided for equipment.

B. Cord Construction: ANSII/NFPA 70, Type SO multiconductor flexible cord with identified equipment -grounding conductor. Suitable for use in damp locations and Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

2.3 IDENTIFICATION AND SIGNS

A. Identification Plates:

1. Provide identification plates for the following unless otherwise specified, for switchboards, unit substations, motor control centers, control panels, push-button stations, time switches, contactors, motor starters, motor switches, panelboards, and terminal cabinets.

2. Identification plates shall be of plastic stock and shall adequately describe function, voltage and phase of identified equipment. Where identification plates are detailed or described on Drawings, inscription and size of letters shall be as indicated. For lighting and power panels, identification plates shall indicate panel designation, voltage, and phase of panel. For terminal cabinets, identification plates shall indicate system contained in terminal cabinet.

3. Identification plates shall be black-and-white nameplate stock of bakelite with characters cut through black exposing white. Plates shall be furnished with beveled edges and shall be securely fastened in place with No. 4 Phillips-head, cadmium-plated steel, self-tapping screws. Characters shall be 3/16 inch high, unless otherwise indicated.

B. Markings:

1. Install identification markings to surface-mounted starters, switches, disconnect switches, contactors, and other devices controlling motors and appliances. Provide abbreviations required along with an identifying number. Markings to be provided with locking type stencils using paint of a contrasting color. Figures shall be 3/8 inch high unless otherwise indicated. Dymo Industries Inc., self-sticking plastic labels, with embossed characters made with a typewriter may be installed instead of stencils and paint; p-touch self adhesive plastic, or Brother P-Touch self sticking laminated plastic labels may be installed.

2. High Voltage: High voltage switchboards, cabinets, boxes, and conduits exposed in accessible locations, including under buildings and in attics, are required to be marked "WARNING-HIGH VOLTAGE- ABOVE 600 VOLTS". Markings for switchboards shall consist of 18 gage steel, porcelain enamel sign of standard manufacture. Markings for boxes, cabinets, and conduits shall be by means of stenciling or printed self-adhesive markers, Westline Tel-A-Pipe, or equal. Provide letters of black on orange background and not less than 1-7/8 inches high. On conduit runs, install markings at intervals not exceeding 10 feet in any individual area. Markings shall be installed after other painting Work is complete.

C. Warning Signs:

1. Provide a warning sign on outside of each door or gate to rooms or enclosures containing high voltage equipment. Signs required reading, "WARNING - HIGH VOLTAGE - KEEP OUT". Provide 2-inch high lettering.

2. Provide a warning sign on each high-voltage non-load break disconnect and fused cutout (not oil filled). Signs required reading, "DO NOT OPEN UNDER LOAD". Provide 2 inch high lettering.

3. Provide signs of standard manufacture, 18 gage steel, with porcelain enamel finish. Provide red lettering on a white background.

PART 3 - EXECUTION

3.1 INSTALLATION AND SUPPORT OF BOXES

A. Install outlet boxes flush with finished surface of wall or ceiling. Install plumb and securely fastened to structure, independent of conduit. Except where otherwise indicated, provide factory-fabricated adjustable attachment bar hangers between studs to support outlet boxes. When installation is performed in fire rated walls, maintain the wall's rating integrity by means of approved fire stop methods.

B. Outlet boxes installed in suspended or furred ceilings with steel runner or furring channels shall be supported, except where otherwise indicated, by a Unistrut P-4000 Tessco A1200HS-10, Cooper B-Line B22s-HG, or equal channel spanning main ceiling runner channels. Each box shall be supported from its channel by a 3/8 inch 16 threaded steel rod with a Unistrut P-4008, Fastenal #48604, Copper B-Line 78101140346 or equal nut and a Tomic No. 711-B Adapta-Stud, or equal. Rod shall be tightened to a jamb fit with channel and its nut. Box shall be locked to rod by means of a 1/2 inch locknut on stud and a 3/8 inch 16 hex nut locking stud to rod.

C. Heights of outlets and equipment indicated on Drawings shall govern. In absence of such indications, following heights shall be maintained with heights measured to centerline unless otherwise noted:

1. Install wall-mounted telephones, light switches, and other switches, 48 inches above finished floor. Refer to other Division 26, 27 and 28 Sections.

2. Outlet boxes for fire alarm pull stations shall be mounted at 45 inches above finished floor to insure that the operating handle of the initiating device is no higher than 48 inches at finished floor. Under no circumstances shall operating handle of the device exceed 48 inches above finished floor regardless of indicated height on drawing.

3. Wall mounted fire alarm strobe or horn/strobe devices shall be mounted such that the entire lens is not less than 80 inches above finished floor. If ceiling heights allow, wall mounted appliances shall have bottom of lens a minimum of 80 inches but not more than 96 inches to the top of lens.

4. Install outdoor fire alarm audible devices or fire alarm sprinkler flow bells at least 10 feet but not more than 12 feet above finished floor to center. Provide STI or equal protective covers for devices when required.

5. Voice evacuation speakers mounted indoors shall be mounted in ceiling space or if mounted on wall shall not be less than 10 feet to center above finished floor.

6. Install clocks and speakers, in classrooms and offices, 8 feet above finished floor. Unless otherwise indicated.

7. In rooms other than places of assembly such as, but not limited to, multipurpose rooms, auditoriums, and libraries, clock outlets and speakers in classrooms and offices shall be mounted 8 feet above finished floors. Other assembly areas such as gymnasiums shall be mounted 10 to 12 feet above finished floor. Provide STI, or equal protective covers for clocks when required.

8. Install fire alarm strobe lights 80 inches to bottom of light above finished floor.

9. Install outside bells and yard light outlets 4 feet above second floor level for 2 or more story buildings, 12 inches below top plate level for one story buildings without covered porch or arcade, and 12 inches below covered porch and arcade ceilings.

10. Install desk telephones, power receptacle outlets, and data outlets 15 inches above finished floor.

11. Install panelboards and terminal cabinets 6 feet 6 inches from finish floor to top of cabinet.

12. Install television outlets at a height corresponding to location of television monitor, or a minimum of 15 inches above finished floor.

13. The use of extension boxes shall be limited to not more than 1 times the original depth of junction box.

3.2 COVER PLATES

A. Provide a plate on each switch, plug, pilot light, data, interphone, public telephone, and television outlet, and on existing and reset outlets where so indicated or required. Plates shall be of stainless steel unless otherwise specified.

B. Flush wiring device and signal system outlets indicated to be blank covered, shall be covered with blank stainless steel plates. Flush lighting outlets to be blanked shall be covered with Wiremold 5736 steel covers, or equal, painted to match surrounding finish. Provide stainless steel covers to blank indicated or required surface-mounted outlets.

C. In the following cases, and at required locations. Switch and receptacle plates shall be engraved with the device(s), or fixtures being controlled, or as indicated:.

1. Three-gang and larger gang switches in locations other than classrooms.

2. Lock switches.

3. Pilot switches.

4. Switches so located that operator cannot see fixtures, or items of equipment controlled while his hand is on the switch.

5. Switches not in same room with fixtures or items of unit heaters, air curtains, fly fans, etcetera.

6. Receptacles operating at other than 120 V shall be identified with the operating voltage.

7. Switches operating on 277 V shall be identified with the operating voltage.

8. Where indicated on Drawings.

D. Designations shall be as indicated on Drawings or as specified by Architect.

E. Standard GFI cover plates shall be Pass & Seymour 4600, Raco 5028-0, or equal. GFI cover plates shall be provided with a CAM lock mechanism with two keys or a padlock hasp that does not protrude through the face of the cover and will allow the shank of locks keyed Corbin No. 60 keys.

3.3 IDENTIFICATION OF CIRCUITS AND EQUIPMENT

A. Provide descriptive nameplates or tags permanently attached to switchboards, motor control centers, transformers, panelboards, circuit breakers, disconnect switches, starters, pushbutton control stations and other apparatus installed for operation or control of circuits, appliances, fire alarm control panel(s), fire alarm annunciator(s), power supplies, terminal cabinets, energy management control units, and Information technology system backbone and distribution equipment points.

B. Provide nameplates of engraved laminated plastic, or etched metal. Submit Shop Drawings denoting dimensions and format to Architect before installation. Fasten to equipment with escutcheon pins, rivets, self-tapping screws, or machine screws. Self-adhering or adhesive backed nameplates are not permitted.

C. Fasten tags to feeder wiring in conduits at every point where runs are broken or terminated, including pull wires in empty conduits. Indicate circuit, phase, and function. Tag branch circuits in panel boards and motor control centers. Tags may be manufactured of pressure-sensitive plastic or embossed self-attached stainless steel or brass ribbon.

D. Provide circuit identification cards and cardholders in all panel boards. Cardholders shall consist of metal frame retaining a clear plastic cover permanently attached to inside of panel door. List of circuits shall be typewritten on a card. Circuit description shall include name or number of circuit, area and connected load.

E. Junction and pull boxes shall have covers stenciled with box number when indicated on Drawings, or circuit numbers according to panel schedules. Data shall be lettered in a conspicuous manner with a color contrasting with finish.

F. Name shall be correctly engraved, with a legend indicating function or areas, when required by codes or indicated on Drawings.

3.4 PROTECTION

A. Protect Work of this section until Substantial Completion.

3.5 CLEANUP

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

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE WIRES (600 VOLT AC)

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes: Low-voltage wire, splices, terminations and installation.

1.2 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 WIRES

A. Wires shall be single conductor type THHN, THWN or THWN-2 insulated with polyvinyl chloride and covered with a protective sheath of nylon, rated at 600 volts. Wires may be operated at 90 degrees C. maximum continuous conductor temperature in dry locations, 90 degrees C. in wet locations for sizes 8 AWG and larger and 75 degrees C in wet locations for sizes 10 AWG and smaller, and shall be listed by UL Standard 83 for thermoplastic insulated wires, listed by Underwriter's Laboratories (UL) for installation in accordance with Article 310 of the California Electrical Code (CEC). Conductors shall be solid copper for 12 AWG and smaller conductors, and stranded copper for 10 AWG and larger conductors. Conductors shall be insulated with PVC and sheathed with nylon. Wires shall be identified by surface markings indicating manufacturer's identification, conductor size and metal, voltage rating, UL symbol, type designations and optional rating. Indentations for lettering are not permitted. Wires shall be tested in accordance with the requirements of UL standard for types THWN-2, THWN or THHN.

B. Conductors shall be solid Class B or stranded Class C, annealed uncoated copper in accordance with UL standards, or another Nationally Recognized Testing Laboratory (NRTL).

2.2 STANDARDS

A. THWN/THHN and THWN-2/THHN wires shall comply with the following standards:

1. UL 83 for thermoplastic insulated wires.

2. UL 1063 for machine tool wires and cables.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wires shall not be installed until debris and moisture is removed from conduits, boxes, and cabinets. Wires stored at the site shall be protected from physical damage until they are installed and walls are completed.

B. Wire-pulling compounds furnished as lubricants for installation of conductors in raceways shall be compounds approved and listed by UL, NRTL, or equal. Oil, grease, graphite, or similar substances are not permitted. Pulling of 2 AWG or larger conductors shall be performed with a cable pull machine. Any runs shorter than 50 feet are exempt. When pulling conductors, do not exceed manufacturer's recommended values.

C. The Project Inspector will observe installation of feeder cables. Notify the Project Inspector not less than two working days in advance of the proposed time of feeder installation.

D. At outlets for light, power, and signal equipment, provide pigtail splices with 8-inch circuit conductor leads for connection to fixtures, equipment, and devices.

E. Pressure cable connectors, pre-insulated 3M Scotchlok, Hubbell Power, O-Z/Gedney or equal, Y, R or B spring-loaded twist-on type, may be furnished in splicing number 8 AWG or smaller wires for wiring systems, except public address and telephone systems.

F. Joints, splices, taps, and connections to switchboard neutral, bonding or grounding conductors, conductors to ground busses, and transformer connections for wires 6 gage and larger shall be performed with high-pressure cable connectors approved for installation with copper conductors. Connectors shall be insulated with heavy wall heat shrink WCSM, or cold-applied roll-on sleeve RVS. Insulation level shall be a minimum of 600V and joints, splices, and taps shall be qualified to ANSI C 119.1, UL, NRTL, or equal listed mechanical pressure connections.

G. Connections to any bussing and high-press cable connectors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

H. Connection of any bonding or grounding conductors shall be securely bolted together with corrosion-resistant plated carbon steel, minimum grade five machine screws secured with constant pressure-type locking devices.

I. Wire switchboards, panel cabinets, pull boxes, and other cabinets except public address, shall be neatly grouped and tied in bundles with nylon ties at 10-inch intervals. In switchboards, panels and terminal blocks, wires shall be fanned out to terminals. If bundles are longer than 24 inches, a maximum of nine current carrying conductors may be bundled together.

J. Install conductor lengths with a minimum length within the wiring space. Conductors must be long enough to reach the terminal location in a manner that avoids strain on the connecting lug.

K. Maintain the conductor required bending radius.

L. Neutral conductors larger than 6 gage, which are not color identified throughout their entire length, shall be taped, painted white or natural gray, or taped white where they appear in switchboards, cabinet, gutters or pull boxes. Neutral conductors 6 gage and smaller shall be white color identified throughout their entire length.

M. Fire alarm and clock wiring shall be continuous from terminal cabinets or from equipment to each device. Splices are not permitted between devices and/or terminal cabinets at junction and pull boxes. Wiring shall be terminated at terminal blocks or devices only.

N. Wiring systems shall be free from short circuits and grounds, other than required grounds. The contractor shall be responsible for the testing of feeder and branch circuit conductor's insulation resistance. The insulation of the conductors shall be tested prior to connections to any panelboards, switchboards, variable frequency drives, lighting control systems, ballasts, and wiring devices such as but not limited to GFI receptacles, TVSS receptacles, or equipment. Insulation testing of panelboards and switchboards shall be independently performed from the insulation testing of any conductors as specified in other sections of this specification.

1. Utilize the services of an approved independent testing laboratory to perform megger time-resistance insulation testing of feeder conductors. Tests must be conducted with wires disconnected at both ends.

    a. Provide calibration program records to assure the testing instrument to be within rated accuracy. The test equipment accuracy shall be in accord with the requirements stated by the National Institute of Standards and Technology (NIST).

    b. Test equipment shall be provided with a label stating the date of last calibration. As a minimum the equipment shall have been calibrated within the past 12 months.

    c. Test reports shall include the following:

        1) Identification of the testing organization.

        2) Equipment identification.

        3) Ambient conditions.

        4) Identification of the testing technician.

        5) Summary of project.

        6) Description of equipment being tested.

        7) Description of tests.

        8) Test results.

        9) Analysis, interpretation and recommendations.

2. Utilize the services of an approved independent testing laboratory or a qualified contractor's employee (Technician certified in accordance with ANSI/NETA ETT-2000 Standard for Certification of Electrical Testing Personnel) to perform megger time-resistance insulation testing of branch circuit conductors. Tests must be conducted with wires disconnected at both ends.

    a. Test equipment and report requirements stipulated under paragraph 3.01.N.1 apply to branch circuit testing.

3. Tests shall be performed in the presence of the Project Inspector.

4. Insulation resistance shall not be less than 100 mega-ohms.

3.2 COLOR CODES

A. General Wiring:

1. Color code conductor insulation as follows:

SYSTEM VOLTAGE		
Conductor	208Y/120	480Y/277
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Natural Gray

Neutrals shall be colored-distinguished if circuits of two voltage systems are used in the same raceway.

2. For phase and neutral conductors 6 gage or larger, permanent plastic-colored tape may be furnished to mark conductor end instead of coded insulation. Tape shall cover not less than 2 inches of conductor insulation within enclosure.

B. Signal Systems: Wires for signal systems shall be color-coded and installed under observation of the Project Inspector. Except where otherwise specified, color-coding shall be as follows:

1. Fire Alarm Systems:

a. Notification Devices (Signal Loop Circuits)
Strobes: Red = Positive, Black = Negative
Horns: Red = Positive, Black = Negative

b. Initiating Devices (Alarm Loop Circuits):
Pull Stations: Yellow and Blue
Smoke Detectors (Circuit): Orange and Brown
Thermal Detectors (Circuit): Orange and Brown
Air Duct Smoke Det. (Circuit): Purple and Gray

c. Initiating Device (Power Circuit): Red = Positive, Black = Negative.

d. Interlocks: Red = Positive, Black = Negative

e. AC Power: Black and White

All underground wiring to be XHHW insulation rated for wet location.

2. Program Clock Circuits:

a. Clocks: Run Black (Label - CRUN)
Reset Red (Label - CRST)
Common = White (Label - - CC)

b. Program Bells: Pink 1st Period (Label - PB1P)
Pink 2nd Period (Label - PB2P)
Pink 3rd Period (Label - PB3P)
Pink 4th Period (Label - PB4P)
Pink = 5th Period (Label - PB5P)
Pink 6th Period · (Label - PB6P)
Common = White (Label - PBC)

c. Night Lights: Brown = N.L. On (Label - NLON)
Brown = N.L. Off (Label - NLOFF)
Common White (Label - NLC)

d. Heat: Purple Heat On (Label - HON)
Purple Heat Off (Label - HOFF)
Common White (Label - HC)

e. Toilet Flush: Yellow Flush On (Label - TFON)
Common White (Label - TFC)

3. Additional requirements:

a. All existing outside bells to be identified and labeled on and at each terminal block.

b. All existing classroom buzzers to be identified and labeled on and at each terminal block.

c. All existing relays located at the master clock to be identified and labeled as to what it controls. Each relay shall be labeled by the use of a white label and black lettering.

d. All wires shall be identified and labeled by the use of white shrink wrap, with black lettering on each end of each wire.

e. All wires shall be placed neatly and tie wrapped into each terminal cabinet, and each terminal block shall be marked as to what circuits it has on it (i.e. Fire Alarm, Clock, program bells, etc.)

3.3 FEEDER IDENTIFICATION

A. Feeder wires and cables shall be identified at each point the conduit run is broken by a cabinet, box, gutter, etc. Where terminal ends are available, identification shall be by means of heat shrink wire markers, which provide terminal strain relief. Markers shall be by Tyco Electronics, Panduit, Brady Perma-Sleeve, or equal. Identification in other areas shall be by means of wrap-around tape markers from Tyco Electronics, Panduit, Brady Perma-Code or equal. Markers shall include feeder designation, size, and description.

3.4 TAPE AND SPLICE KITS

A. Splices, joints, and connectors joining conductors in dry and wet locations shall be covered with insulation equivalent to that provided on conductors. Free ends of conductors connected to energized sources shall be taped. Voids in irregular connectors shall be filled with insulating compound before taping. Thermoplastic insulating tape approved by UL, NRTL, or equal for installation as sole insulation of splices shall be furnished and shall be installed according to manufacturer's printed specifications.

3.5 TAGGING

A. General: Install identification markers on ungrounded conductors of all circuits, in switchboards, panel boards, pull, junction and outlet boxes, lighting fixtures, switches, receptacles and other terminating enclosures. Grounded circuit conductors shall have identification markers in switchboards, panel boards, and all enclosures where more than one circuit grounded circuit conductor is installed. Identification shall include switchboard, panel board, or other source and circuit number. Tags shall be 3M Co. "Scotchcode" " write-on tape or shall be premarked with self-adhesive wraparound type EZ Code, Brady.

B. Tagging: Conductors shall be lagged in each junction box, pull box, wireway or auxiliary gutter and at each device, motor outlet, panel board, switchboard or other conductor termination. Tag shall show feeder number, size. Phase and origin

3.6 MISCELLANEOUS (AS APPLICABLE)

A. Make all branch circuit and fixture joints for #10 AWG and smaller wire with UL approved connectors, listed for 600 volts. Provide Minnesota Mining and Manufacturing Co. insulated "Scotchlocks,", Ideal Co. “Wing-Nut”, or T &B Burndy Co. “Piggy" connectors.

B. Make all branch circuit joints of #8 AWG and larger with screw pressure lugs, and insulate with electrical tape to 150% of the insulating value of the conductor insulation.

C. Tape all connections made with non-insulated type connectors with half-lapped, rubber-type tape, to 1-1/2 times the thickness of the conductor insulation, then cover with Scotch #33 tape.

D. Each circuit must correspond to the branch circuit number indicated on the panel schedule shown on the drawings except where departures are approved by the Engineer.

E. Neatly group or tape together wiring within equipment enclosures.

F. Where conductors in conduit pass through exterior walls, a sealing compound of moisture-resistant material shall be applied in the ends of the conduits to seal around the conductors.

G. Megger tests shall be taken on all feeder conductors and on all conductors for motors over 15 HP. Tests shall be made in presence of the District's representative and prior to connection of equipment. Written reports of results shall be submitted to the Engineer. Conductors testing below manufacturers standard shall be replaced at no expense to the owner.

3.7 PROTECTION

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

3.8 CLEANUP

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

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide and install grounding system as indicated or required.

B. Related Requirements:

1. Refer to related sections for their system grounding requirements.

2. Section 26 05 00: Common Work Results for Electrical.

3. Division 27: Communications.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. IEEE 142 Green Book.

2. Underwriter's Laboratories (UL).

3. California Electrical Code.

4. Building Industry Consultant Services International (BICSI) (Signal).

5. EIA/TIA (Signal and power).

6. Nationally Recognized Testing Laboratory (NRTL) or equal.

7. Motorola R56 Standards.

1.3 SYSTEM DESCRIPTION

A. Metallic objects on the Project site that enclose electrical conductors, or that are likely to be energized by electrical currents, shall be effectively grounded.

B. Metal equipment parts, such as enclosures, raceways, and equipment grounding conductors, and earth grounding electrodes shall be solidly joined together into a continuous electrically conductive system.

C. Metallic systems shall be effectively bonded to the main grounding electrode system.

D. A separately derived AC source shall be grounded to the equipment grounding conductor, and to separate “made” electrode of building grounding electrode system.

E. Electrical continuity to ground metal raceways and enclosures, isolated from equipment ground by installation of non-metallic conduit or fittings, shall be provided by a green insulated grounding conductor of required size within each raceway connected to isolated metallic raceways, or enclosures at each end. Each flexible conduit shall be provided with a green insulated grounding conductor of required size.

F. Cold water, UFER ground or other utility piping systems, shall not be utilized as grounding electrodes due to the installation of insulating couplings and non-metallic pipe in such installations. In addition to bonding to cold water pipe provide at least one of the following made grounding electrodes:

1. A dedicated “made” electrode, fabricated of at least 20 feet of galvanized 1/2 inch diameter rebar encased by at least two inches of concrete, and placed next to the bottom of a concrete foundation, or footing in direct contact with earth A welded extended portion shall surface at the location of the common grounding electrode bus bar and be extended by a 3/0 CAD welded bare copper cable, or be CAD welded directly to the bus. The CAD weld shall be at least four inches above finished floor in a dry location. The main grounding electrode and associated grounding conductors shall be in an enclosure and in conduit.

2. Grounding electrodes as specified hereafter in this section.

3. Concrete enclosed electrode, fabricated of at least 20 feet of No. 2 AWG, minimum size, bare copper conductor, encased by at least two inches of concrete, located within or near bottom of a concrete foundation, or footing, which is in direct contact with earth. Footing rebar shall be connected to copper wire with approved connectors. An external electrode, as specified hereafter or as required by the CEC, shall be installed and connected to foundation or footing rebar.

G. Non-current carrying metal parts of high-voltage equipment enclosures, signal and power conduits, switchboard and panelboard enclosures, motor frames, equipment cabinets, and metal frames of buildings shall be permanently and effectively grounded. Provide a CEC sized grounding conductor in every raceway.

H. Metallic or semi-conducting shields and lead sheaths of cables operating at high voltage, shall be permanently and effectively grounded at each splice and termination.

I. Neutral of service conductors shall be grounded as follows:

1. Neutral shall be grounded at only one point within the Project site for that particular service. Preferable location of grounding point shall be at the service switchboard, or main switch.

2. Equipment and conduit grounding conductors shall be bonded to that grounding point.

3. If other buildings or structures on the Project site are served from a switchboard or panelboard in another building, power supply is classified as a feeder and not as a service.

4. Equipment grounding conductor is installed from switchboard to each individual building. At building, grounding conductor is bonded with power equipment enclosures, metal frames of building, etc., to “made” electrode for that building.

5. Feeder neutrals shall be bonded at service entrance point only, neutrals of separately derived systems shall be bonded at the source only.

J. If there is a distribution transformer at a building the secondary neutral conductor shall be grounded to “made” electrode serving the building.

K. Within every building, the main switchboard or panelboard, shall be bonded to the cold water line. Metallic piping systems such as gas, fire sprinkler, or other systems shall be bonded to the cold water line.

1.4 SUBMITTALS

A. Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Furnished yard boxes shall be precast concrete and shall be approximately 14 inches wide by 19 inches long by 12 inches deep or larger, if necessary to obtain required clearances. Boxes shall be furnished with bolt-down, checkered, cast iron covers and cast iron frames cast into boxes. Yard boxes shall be Jensen Precast, Oldcastle Precast, Western Precast, Kistner, or equal.

B. “Made” electrodes shall be copper-clad steel ground rods, minimum 3/4 inch diameter by ten feet long.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grounding electrodes shall be installed in the nearest suitable planting area, where not otherwise indicated on Drawings, and each electrode shall terminate within a concrete yard box installed flush with finish grade. In planting areas, finish elevation of concrete yard boxes shall be two inches above planting surfaces.

B. If concrete enclosed electrode is provided, grounding wire shall be terminated to a suitable copper plate with grounding lugs and must be enclosed in a raceway or box..

C. Grounding rods shall be driven to a depth of not less than eight feet. Permanent ground enhancement material, (GEM) as manufactured by Erico Electrical Products, Loresco Powerset, Tessco Ultrafil or equal, shall be installed at each ground rod to improve grounding effectiveness. Install in accordance with manufacture's installation instructions.

D. Grounding electrodes shall provide a resistance to ground of not more than 25 ohms.

E. When installing grounding rods, if resistance to ground exceeds 25 ohms, two or more rods connected in parallel, or coupled together shall be provided to meet grounding resistance requirements.

F. Ground rods shall be separated from one another by not less than ten feet.

G. Parallel grounding rods shall be connected together with recognized fittings and grounding conductors in galvanized rigid steel conduit, buried not less than 12 inches below finish grade.

3.2 TESTING

A. Provide the services of an approved independent testing laboratory to test grounding resistance of “made” electrodes, ground rods, bonding of building steel, water pipes, gas pipes and other utility piping. Tests shall be performed as follows:

1. Visually and mechanically examine ground system connections for completeness and adequacy.

2. Perform fall of potential tests on each ground rod or ground electrode where suitable locations are available per IEEE Standard No. 81, Section 8.2.1.2. Where suitable

locations are not available, measurements will be referenced to a known dead earth or reference ground.

3. Perform the two point method test per IEEE No. 81, Section 8.2.1.1 to determine ground resistance between ground rod and building steel, and utility piping - such as water, gas and panelboard grounds. Metal railings at building entrances and at handicapped ramps shall also be tested.

4. Test shall be performed in the presence of the Inspector.

B. Submit 3 copies of test results to the Architect. Test results shall be submitted on an official form from the independent testing laboratory recording Project location, test engineer, test conditions, test equipment data, ground system layout or diagram, and final test results.

3.3 PROTECTION

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

3.4 CLEANUP

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

END OF SECTION

SECTION 26 05 33

RACEWAYS, BOXES, FITTINGS, AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Raceways and wire ways.
2. Conduit installation.
3. Underground requirements.

B .Related Requirements:

1. Section 26 05 00: Common Work Results for Electrical.
2. Section 26 05 13: Basic Electrical Materials and Methods.
3. Division 27: Communications.
4. Division 28 - Electronic Safety and Security.

C. Applicable Standards and Codes.

1. EIA/TIA 569 Standards.
2. National American Standards Institute (ANSI).
3. National Electrical Manufacturer's Association (NEMA).
4. Nationally Recognized Testing Laboratory (NRTL).
5. California Electrical Code (CEC).
6. Uniform Building Code (UBC).
7. Underwriters Laboratory (UL).

1.2 SUBMITTALS

A. Materials List: Provide in accordance with Division 01.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Conduit Materials:

1. Metallic conduit, and tubing shall be manufactured under the supervision of an UL, or another NRTL factory inspection and label service program. Each ten-foot length of conduit and tubing shall bear the UL or another NRTL label and manufacturer's name.

2. Rigid metallic conduit shall be rigid steel, heavy wall, mild steel, zinc-coated, with an inside and outside protective coating manufactured in accordance with ANSI C 80.1. Couplings, elbows, bends, conduits, bushings and other fittings shall be the same materials and finish as the rigid metallic conduit. Fittings, connectors, and couplings shall be threaded type, manufactured in accordance with ANSI C 80.1 and UL 6.

3. Electrical metallic tubing shall be steel tubing, zinc-coated with a protective enamel coating inside, manufactured in accordance with NEMA C 80.3. Fittings, couplings, and connectors shall be gland compression type, set screw couplings and connectors not permitted. All parts shall be manufactured in accordance with NEMA C80.3 and UL 6A Electrical metallic tubing is designated hereinafter as EMT. Steel and rain tight fittings shall be approved and listed for the intended application.

4. Flexible steel conduit shall be of flexible interlocking strip construction with continuous zinc coating on strips, manufactured in accordance with UL 1.

    a. Connectors and couplings shall be required fittings of the type, which threads into convolutions of flexible conduit.

5. Liquid-tight flexible metal conduit shall be galvanized heavy wall, flexible locked steel strip construction, UV rated, with smooth moisture and oil-proof, abrasion-resistant, extruded plastic jacket. Connectors shall be as required for installation with liquid-tight flexible conduit and shall be installed to provide a liquid-tight connection.

6. Non-metallic conduit shall be rigid PVC electrical conduit extruded to schedule 40 dimensions of Type II. Grade 1 high impact, polyvinyl chloride, sweeps, couplings, reducers and terminating fittings shall be listed under the UL, or another NRTL, and shall bear the manufacturer's listed marking.

7. Multi-cell raceway shall be four inch PVC, Type 40, UL or another NRTL listed for underground use with optical fiber and signal system cables. Raceway shall be furnished with 3-1/2 inch factory installed inner ducts with required internal spacers, and required couplers, sweeps, and end bells. Multicell raceway shall be Carlon Multigard, or District approved equal.

8. Metal Clad (MC) cable system is not allowed.

B. Sleeves for Conduits: Sleeves shall be adjustable type by Carlon, U.S. Plastic, PEP Plastic or equal.

C. Where conduit enters a building through a concrete foundation below grade, or ground water level, or where it is necessary to seal around a conduit where it passes through a concrete floor or wall, provide O-Z/Gedney Type FSK Thru Wall and Floor Seal, equivalent Cooper Crouse Hinds Thru-Wall, Legrand Thru-Wall, or equal.

D. Expansion Joints-Seismic Separations between building(s) and other locations as indicated on drawings:

1. Provide Thomas & Betts XJG-TB, O-Z/Gedney. type AX with bonding strap and clamps, Cooper XJGD or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-

Z/Gedney type EX, Cooper XJGD, or equal. Provide O-Z/Gedney type AXDX, or equal combination deflection/expansion fittings at all seismic separations. Provide manufacture's internal and external bonding jumpers at all locations. Liquid-tight metal conduit or flexible metal conduit shall not be approved at expansion joints, separations between buildings or seismic separations.

2. Provide expansion fittings at intervals not exceeding 100 feet in conduits exposed to direct sunlight. Fittings may be installed in the conduit run or where conduit attaches to junction or pull boxes. OZ/Gedney type AX, TX or EXE series, or equivalent by Thomas and Betts, Crouse-Hinds or approved equal.

E. Conduit Seal Fittings:

1. Provide conduit seal fittings where indicated on the Drawings. Conduit seals shall be of rigid galvanized steel. Seals in horizontal conduit installations shall be Thomas & Betts EYS, Appleton Type ESU, Crouse Hinds Type EYS, or equal. Seals in vertical conduit installations shall be Thomas & Betts EYD, Appleton Type SF, Crouse Hinds Type EYD, or equal, with continuous drain. When installing conduit seals make provision for percent fill space reduction in accordance with CEC.

2. Install sealing compound after wire has been installed. Ensure drain is not blocked in vertical seals when installing compound. Where conduit seals are installed in hazardous area applications, there shall be no conduit coupling, fitting, etc., between seal and boundary of hazardous area.

F. Surface Steel Raceway:

1. The surface steel raceway system for branch circuit wiring, data network, voice, video, and other low voltage wiring shall be as manufactured by the Wiremold Company, Hubbell, or Mono-Systems, Inc. or equal. The raceway system may be supplied pre-wired in accordance with all sections of these specifications and requirements herein, and shall be UL or another NRTL listed. Computer data installation shall be as required by other sections of this Division.

   a. If furnished pre-wired, the system must be listed in accordance with UL or another NRTL for "Multiple Outlet Assemblies" and so labeled on interior of the assembly. The pre-wired installation must contain no extra wire splices in the raceway as compared to a contractor assembled installation assembled from components. The pre-wired steel raceway shall be Hi-Pot tested at the factory to prevent any potential bare wire or shot circuit defects.

2. The raceway base, cover, and device bracket shall be manufactured of steel and finished in ivory, gray enamel or custom colors suitable for field painting to match adjacent finishes.

3. The raceway shall be a two-piece design with a metal base and snap-on metal cover, except for the Wiremold V700 system, Hubbell HBL750 series and Mono-Systems Inc. S145-700 series that shall be a one-piece design. The base and cover sections shall be a minimum of 0.040 inch wall thickness. The base section shall be available in ten-foot lengths. A hand-operated cutting tool shall be available for the base and cover to ensure clean, square cuts. Wiremold V500, Hubbell V500, and Mono Systems inc. SM500 series are not permitted.

4. A full complement of fittings shall be furnished, including but not limited to, flat internal and external elbows, tees, entrance fittings, wire clips, cover clips, couplings, support clips, C-hangers and end caps. The fitting color shall match the raceway color. Fittings shall be supplied with a base where indicated and/or required. A take-off fitting shall be furnished as required to adapt to existing flush wall boxes.

5. Device brackets shall be furnished for mounting single or two-gang devices within the raceway. Devices shall be provided with the ability of mounting flush or in conjunction with standard steel, stainless steel, or manufacturer's metal faceplates.

6. The raceway shall be furnished with a complete line of connectivity outlets and modular inserts for unshielded twisted pair including category 5, fiber-optic, coaxial, and other cabling types with face plates and bezels to facilitate installation. Computer data installation shall be as required by other sections of this Division, and Division 27.

7. Raceway shall be furnished with corner elbows and tee fittings to maintain a cable bend radius which meets the requirements of fiber-optic and copper cables under EIA/TIA 569 for communications pathways.

G. Factory Pre-Wired Surface Metal Raceway:

1. Furnish and install pre-wired surface metal raceways as indicated on Drawings and as specified.

2. Metal Raceway shall be galvanized steel Wiremold V4000, Hubbell 4000 series, or Mono-Systems Inc. SMS-4000 series complete with raceway base, cover, fittings, receptacles and mounting plates required for a complete assembly. Raceway shall have two wiring compartments with integral dividing barrier for isolating the wiring compartments.

3. Pre-wired assembly shall be UL, or another NRTL listed as a multi-outlet assembly and surface raceway as labeled on interior of assembly.

4. Wiring devices and other components shall be factory installed, electrically wired and covers labeled as indicated on drawings. Each receptacle shall be identified with panelboard and circuit number from which it was fed. Grounding shall be maintained by means of factory installed grounding conductors.

5. Where shown on Drawings, Raceway covers shall have provisions for mounting computer data outlets.

6. Complete assembly is to consist of required fittings such as elbows, slide couplings for joining raceway sections, blank end caps and flat tees.

7. Prewired assembly must contain no wire splices.

8. Receptacles and wiring shall be as indicated on drawings and as specified.

9. Where raceway is used for power and computer data outlets, installation of data outlets shall be as required by other sections of this specification.

10. Prior and during installation, verify and comply with manufacturer's installation instructions.

11. Entire assembly shall be tested for shorts, opens, ground faults, and wire insulation at factory and certified. Raceways shall be electrically continuous and bonded in accordance with California Electrical Code.

12. Submit shop drawings for approval showing the complete layout of all components of each raceway, raceway lengths, each component description, location and circuit identification.

13. All wiring devices shall be removable without requiring disassembly of wireway.

14. Standard non OEM wiring devices shall be used as specified in District's specifications.

H. Wireways shall be 16 gage galvanized steel enclosed hinge/screw wiring troughs, surface metal raceway, wireway, and auxiliary gutter designed to enclose electrical wiring. Wireway fittings shall be furnished with removable covers and sides to permit complete installation of conductors throughout the entire wireway run. Cover shall be furnished with keyhole slots to accept captive screws locking the cover securely closed. Wireways shall be UL or another NRTL listed, and shall be Square D Type LDB NEMA-1 enclosure for interior applications, or Type RDB NEMA-3R enclosure for exterior applications, or equal by Cooper B-line, Hoffman, Wire Guard, or Circle AW.

I. Penetration in Fire-Rated Structures: Provide 3M, or equal, sealant and fire barriers for installing fire-rated seals around penetrations through floors, walls, and elevator hoistways. Fire stop system must be UL, or another NRTL listed, and classified for through-penetration applications of metallic conduits and busways.

J. Pull Wires: Install 1/8 inch polypropylene cords in empty or spare conduits.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

A. General Requirements:

1. Provide complete and continuous systems of rigid metallic conduit, outlet boxes, junction boxes, fittings and cabinets for systems of electrical wiring including lighting, power, and signal systems, except as otherwise specified.

2. EMT may be installed in interior concealed applications and in areas approved by owner. EMT shall not be installed in concrete, directly buried underground, outdoors, in boiler rooms, elevator pits, or where subject to damage.

3. Within buildings, flexible steel conduit may be installed instead of rigid steel conduit where permitted by code. Flexible steel conduit shall be installed:

a. For continuous lengths not exceeding more than 50 feet between pull points (pull boxes, outlet boxes, etcetera).

b. With no maximum total raceway length located within a building interior when the flex is located in concealed locations.

4. Flexible Steel conduit shall not exceed 1-1/2 inches in size.

5. Liquid-tight flexible steel conduit shall only be installed, except where otherwise specified, for final connection of motor terminal boxes, shop equipment, cafeteria equipment, HVAC equipment and other equipment, or for frequent interchange, and shall be of sufficient length, not exceeding 36 inches, to permit full travel or adjustment of motor on its base. Liquid-tight flexible conduit shall not be used for equipment not requiring adjustment or frequent interchange.

6. Connectors for flexible metal conduit shall be made of steel, and of the types which threads into convolutions of conduit. Connectors for watertight flexible metal conduit shall be as required for installation and shall be installed to provide a watertight connection.

7. Exposed conduit shall be installed vertically and horizontally following the general configuration of the equipment, using cast threaded hub conduit fittings where required and shall be clamped to equipment with suitable iron brackets and one hole pipe strap.

8. If connection is from a flush wall-mounted junction box, install an approved extension box.

9. Underground feeder distribution conduits for systems may be non-metallic conduit instead of rigid conduit except where otherwise specified or indicated.

10. Conduit shall be concealed unless otherwise indicated. Conduits exposed to view, except those in attic spaces and under buildings, shall be installed parallel or at right angles to structural members, walls, or lines of building. Conduits shall be installed to clear access openings.

11. Bends or offsets will not be permitted unless absolutely necessary. Radius of each conduit bend or offset shall be as required by ordinance. Bends and offsets shall be performed with standard industry tools and equipment or may be factory fabricated bends or elbows complying with requirements for radius of bend specified. Heating of metallic conduit to facilitate bending is not permitted. Public telephone conduit bends and offsets shall be provided with a radius which is not less than ten times trade size of conduit unless otherwise permitted. Refer to underground installation, specified in this section, for radius of bends and offsets required for underground installations.

12. Running threads are not permitted. Provide conduit unions where union joints are necessary. Conduit shall be maintained at least six inches from covering of hot water and steam pipes and 18 inches from flues and breechings. Open ends of conduits shall be sealed with permitted conduit seals during construction of buildings and during installation of underground systems.

13. Expansion Joints/Seismic Separations/Separations between buildings/Locations Indicated: Provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type AX with bonding strap and clamps, Crouse Hinds XJGD, or equal. At exterior locations, provide Thomas & Betts XJG-TB, O-Z Electrical Mfg. Co. Inc. Type EX, Crouse Hinds XJGD, or equal. Provide Crouse Hinds, Thomas & Betts, or O-Z Electrical Mfg. Co. Type AXDX, or equal Combination Deflection/Expansion Fittings at all seismic separations. Provide manufactures internal and external Bonding Jumpers at all locations. Liquid-tight flexible conduit shall not be approved at expansion joints or seismic separations.

14. Where conduits are terminated in groups at panelboards, switchboards, and signal cabinets, etc., provide templates or spacers to fasten conduits in proper position and to

preserve alignment. Conduits terminating at signal cabinets shall only enter cabinets in the following locations:

a. Conduits entering top, side, and bottom of cabinets shall be aligned in a single row, centered two inches from rear of cabinet.

b. Conduits entering back of cabinet shall be aligned in a single row centered two inches from top of cabinet.

c. Conduits shall not be spaced closer than three inches on centers.

15. Conduits above metal lath ceilings shall be rigidly suspended with pipe hangers or pipe racks or shall be secured to superstructure with factory fabricated pipe straps. Conduits in metal lath or steel stud partitions shall be tied to furring channels or studs. In ceiling spaces and in partitions, tie wires shall be spaced not more than 5 feet apart, shall fasten conduit tight against channels and studs at point of tie and shall not support any of conduit weight. Tie wire shall be 16 gage galvanized double annealed steel.

16. Where auxiliary supports, saddles, brackets, etc., are required to meet special conditions, they shall be fastened rigid and secure before conduit is attached.

17. Conduit in ceiling spaces, stud walls, and under floors, shall be supported with factory fabricated pipe straps or shall be suspended with pipe hangers or pipe racks. Pipe straps shall be attached to and shall fasten conduit tight at point of support against ceiling and floor joists, rafters, and wall studs, or two-inch x four-inch headers fitted between joists or wall studs.

18. Conduits installed on exposed steel trusses and rafters shall be fastened with factory fabricated conduit straps or clamps, which shall fasten conduit tight against supporting member at point of support.

19. Conduits installed under buildings shall be strapped with factory fabricated conduit straps to underside of concrete floor or joists, or wood floor joists, or shall be suspended with pipe hangers or pipe racks. Conduits under building are not permitted to be placed directly on grade; they shall be suspended from building or shall be buried below surface or ground. 1-1/4 inch and larger conduits under buildings shall be installed with conduit hangers or racks.

20. Pipe hangers for individual conduits shall be factory fabricated. Steel rods shall be 3/8 inch for two-inch conduit hangers and smaller and shall be 1/2 inch for 2 ½-inch conduit hangers and larger.

21. Pipe racks for groups of parallel conduits and for supporting total weights not exceeding 500 pounds shall be trapeze type and shall consist of a cross channel, Steel City Kindorf B-900, Unistrut P-1000, equivalent Cooper B-Line or equal, suspended with a 3/8 inch minimum diameter steel rod at each end. Rods shall be fastened with nuts, top and bottom to cross-channel and with square washers on top of channel. Conduits shall be clamped to top for cross-channel with conduit clamps, Steel City Kindorf C-105 or Unistrut P-1111 through P-1124, equivalent Cooper B-Line, or equal. Conduits shall not be stacked one on top of another, but a maximum of two tiers may be on same rack providing an additional cross-channel is installed. Where a pipe rack is to be longer than 24 inches, or if the supported weight exceeds 500 pounds, submit Shop Drawings of installation to the Architect for review.

22. Conduits suspended on rods more than two feet long shall be rigidly braced to prevent horizontal motion or swaying. Installation shall meet zone 4 seismic requirements.

23. Factory fabricated pipe straps shall be one or two-hole formed galvanized clamps, heavy-duty type, except where otherwise specified.

24. Hangers, straps, rods, or pipe supports under concrete shall be attached to inserts set at time concrete is placed, or with approved concrete anchors. Under wood, install bolts, lag bolts, or lag screws; under steel joists or trusses, install beam clamps. Contractor shall submit size of anchors, bolts, screws, and installation method to Architect for approval prior to start of any work.

25. Conduits shall be supported at intervals required by code, but not to exceed ten feet. One inch and smaller exposed conduits shall be fastened with one-hole malleable iron straps. Perforated straps and plumber's tape is not permitted for the support of conduits.

26. Conduits stubbed up through a roof or an arcade shall be flashed with a waterproof flashing. Refer to Division 07 for additional requirements.

27. Bushings and locknuts for rigid steel conduit shall be steel threaded insulating type. Setscrew bushings are not permitted.

28. Flex conduits shall be cut square and not at an angle.

29. Routing of conduits may be changed providing length of any conduit run is not increased more than ten percent of the length indicated on Drawings.

B. Underground Requirements:

1. Conduits and multicell raceways installed underground shall be entirely encased in three inch thick concrete on all sides , except where otherwise specified. Provide required spacers to prevent any deflection when concrete is placed and to preserve position and alignment. Conduits and raceways shall be tied to spacers. Anchors shall be installed to prevent floating of conduits and raceways during placing of concrete. Provide red colored concrete to encase conduits of systems operating above 600 volts.

2. Underground conduits and raceways shall be buried to a depth of not less than 24 inches below finished grade to top of the concrete envelope, unless otherwise specified.

3. Assemble sections of conduit with required fittings. Cut ends of conduit shall be reamed to remove rough edges. Joints in conduits shall be provided liquid-tight. Bends at risers shall be completely below surface where possible.

4. Conduits and raceways in a common trench shall be separated by at least three inches of concrete. Electrical power and/or lighting conduit runs installed in a common trench with conduits containing signal system wiring such as public address, telephone, intrusion detection, fire alarm, television, computer networking, and clock systems shall maintain a separation of a minimum of six inches from these types of signal system conduits and raceways. Electrical power, lighting and signal conduits and raceways installed in a common trench with other utility lines such as gas, water, sewer and storm lines shall maintain 12 inches separation from these types of utility lines.

5. The Inspector will observe underground installations before and during concrete placement. A mandrel shall be drawn through each run of conduit in presence of the

Inspector before and after placing concrete. Mandrel shall be six inches in length minimum, and have a diameter that is within 1/4 inches of diameter of conduit to be tested.

6. Non-metallic conduit installations shall comply with following additional requirements. Joints in PVC conduit shall be sealed by means of required solvent-weld cement supplied by conduit manufacturer. Non-metallic conduit bends and deflections shall comply with requirements of applicable electrical code, except that minimum radius of any bend or offset for conduits sized from 1/2 inch to 1 ½-inch inclusive shall not be less than 24 inches. Bends at risers and risers shall be PVC-coated rigid steel conduit. Radius of curve of bends or offsets in non-metallic conduit for public telephone system shall be not less than ten times trade size of conduit, unless otherwise specifically permitted.

7. Furnish and install a six-inch wide, polyethylene, red underground barrier type 12 inches above full length of concrete reading, "CAUTION ELECTRIC LINE BURIED BELOW".

8. Underground conduit systems provided for utility companies shall be furnished to meet the requirements of the utility companies requiring service.

9. Protect inside of conduit and raceway from dirt and rubbish during construction by capping openings.

10. Add bell-end bushings for conduit stub-up including underground entries to pull boxes, and manholes. Under floor standing switchboards and motor control centers provide a four-inch galvanized nipple with ground bushing.

11. Underground conduit for systems operating above 600 volts shall be a minimum size of four inches.

12. At portable classroom all stub ups shall be installed with a coupling flush to finish grade.

13. Underground conduits and raceways shall be swabbed prior to wire pull.

C. General Installation Requirements for Computer Network System Conduits:

1. Location of outlet boxes and equipment on Drawings is approximate, unless dimensions are indicated. Drawings shall not be scaled to determine position and routing of wireways, drops, and outlet boxes. Location of outlet boxes and equipment shall conform to architectural features of the building and other Work already in place and must be ascertained in the field before start of Work.

2. The maximum pulling tensions of the specified cables shall not be exceeded and proper radius of cable bends shall be maintained.

3. For computer network wiring, conduit types shall be limited to rigid metal conduit, electrical metallic tubing, schedule 40 PVC, multi-cell raceways, and flexible metallic conduit for lengths less than six feet.

4. Interior section of conduit run shall be not longer than 100 feet and shall not contain more than two bends of 90 degrees between pull points or pull boxes.

5. The inside radius of a conduit bend shall be at least six times the internal diameter of the conduit. When the conduit size is greater than two inches, the inside radius shall be at least ten times the internal diameter of the conduit. For fiber-optic cable, the inside radius of a conduit bend shall be at least ten times the internal diameter of the conduit.

6. Conduit shall be sized in accordance with Table 4.4-1 of EIA/ TIA 569 standard.

7. Splicing or terminating cables in pull boxes is not permitted.

8. For indoor application, a pull box shall be provided in conduit run where:

   a. The length is over 100 feet.

   b. There are more than two bends of 90 degrees.

   c. There is a reverse bend in the run.

9. Boxes shall be provided in a straight section of conduit and shall not be installed in lieu of a bend. The corresponding conduit ends are to be aligned with each other. Conduit fittings shall not be installed in place of pull boxes.

10. Where a pull box is provided with raceways, pull box shall comply with the following:

    a. For straight pull-through, provide a length of at least eight times the trade-size diameter of the largest raceway.

    b. For angle and U-pulls:

       1) Provide a distance between each raceway entry inside the box and the opposite wall of the box of at least six times the trade-size diameter of the largest raceway, this distance being increased by the sum of the trade-size diameters of the other raceways on the same wall of the box.

       2) Provide a distance between the nearest edges of each raceway entry enclosing the same conductor of at least:

          a) Six times the trade-size diameter of the raceway; or

          b) Six times the trade-size diameter of the larger raceway if they are of different size.

          c) For a raceway entering the wall of a pull box opposite to a removable cover, provide a distance from the wall to the cover of not less than the trade-size diameter of the largest raceway plus six times the diameter of the largest conductor.

11. Drawings generally indicate Work to be installed, but do not indicate all bends, transitions of special fittings required to clear beams, girders or other Work already in place. Investigate conditions where conduits and wireways are to be installed, and furnish and install required fittings.

D. Slabs on Grade:

1. Unless specifically reviewed by the Architect and DSA, conduits 1 ¼-inches and larger are not permitted to be installed in structural concrete slabs. Where conduits are permitted, and are installed in concrete slabs on grade, slabs shall be thickened at bottom where conduits occur to provide three inches of concrete between conduit and earth. Required excavation shall be part of the Work of this section.

2. If concrete slab is five inches or more in thickness with a moisture barrier plastic sheet between earth and slab, one inch and smaller conduits shall be installed in the slab with a minimum of one inch concrete between earth and conduit.

E. Concrete Walls, Beams, and Floors: Provide sleeves where conduits pierce concrete walls, beams, and floors, except floor slabs on grade. Sleeves shall provide 1/2 inch clearance around conduits. Sleeves shall not extend beyond exposed surfaces of concrete and shall be securely fastened to forms. Where conduits pass through walls below grade, seal with required sealant and backer materials between conduit and sleeve to provide a watertight joint. Sealant shall be as indicated in Section 07 92 00: Joint Sealants.

3. 2 STUBS

A. Panelboard: Install two one inch conduits from each flush mounted panelboard to access under floor space and to access above ceiling space where these conditions occur. Cap conduits with standard galvanized pipe caps.

B. Floor: At points where floor stubs are indicated in open floor areas, for connections to machines and equipment, conduits shall be terminated with couplings, tops flush with finished floor. Stubs shall extend above couplings the indicated distance. Where capped stubs are designated, couplings shall be closed with cast iron plugs with screw drive slots.

C. Underground:

1. Underground conduit stubs shall be terminated at locations indicated, and shall extend five feet beyond building foundations, steps, arcades, concrete walks and paving. Rigid metallic conduit stubs and non-metallic conduit stubs shall be capped by installing a coupling flush in end wall of concrete encasement and plugging with a permitted plug. Project record drawings shall indicate location of ends of underground conduit stubs fully dimensioned and triangulated with reference to buildings or permanent landmarks. These dimensions, including depth below finished grade, shall be marked on project record drawings in presence of the Inspector before backfilling trench. Where extending existing concrete encased stubs, clean, chip and wire brush end of existing concrete and brush on a heavy coat of neat cement paste or epoxy bonding agent.

2. Over ends of individual underground conduit stubs or groups of conduit stubs, install four-inch by 18-inch deep PVC filled with concrete, flush with finished grade in asphaltic concrete or lawns, and two inches above finished grade in planting areas. Cast a three-inch by three-inch brass plate engraved "ELECT" flush in top of concrete. Secure plate to concrete with brass dowels or as indicated on drawings.

3.3 PROTECTION

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

3.4 CLEANUP

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

END OF SECTION

SECTION 32 16 23
CONCRETE SITEWORK

1.00 GENERAL

1.01 DESCRIPTION

A. Concrete sitework/off-site work as indicated on the drawings and specified herein, including, but not limited to local and Public Works Agencies.

1.02 RELATED WORK SPECIFIED ELSEWHERE AS REQUIRED

A. Reinforcing Steel, Section 03 20 00.

B. Joint Sealants, Section 07 92 00.

1.03 SUBMITTALS

A. See requirements for referenced related work. Provide a sample panel for review in accordance with Section 01 33 00.

1.04 QUALITY ASSURANCE

A. All work shall be constructed and inspected in conformance with the requirements of the State of California, "Standard Specifications for Public Works Construction" (PWC).

2.00 MATERIALS

2.01 AGGREGATE BASE

A. Conform to crushed aggregate base per PWC Section 200-2.2.

2.02 REINFORCEMENT

A. Conform to the requirements of Section 03 20 00.

2.03 CONCRETE

A. Materials for Cast-In-Place Concrete and formwork shall conform with Section 03300 and Structural General Notes, except that the 28 days compressive strength of concrete, used for sitework shall be as designated in PWC Section 201, minimum strength 3000 psi at 28-days, except as otherwise indicated.

B. Expansion Joint Pre-Molded Filler: Conform to ASTM D1751. See Section 07920 for Sealant.

3.00 EXECUTION

3.01 COORDINATION

A. Off-site work of this Section shall be installed prior to the completion of the Work, when off-site demolition is complete, utility connections are complete and barricades are removed.

B. All other concrete shall conform to Division 3, Concrete.

3.02 SUBGRADE

A. Subgrade shall be prepared in accordance with PWC Section 301-1 and the recommendations of the Geotechnical report.

B. Base shall be prepared in accordance with PWC Section 301-2.

3.03 FORMWORK

A. Form all exposed vertical surfaces in conformance with Division 3.

3.04 REINFORCING STEEL

A. Placement shall conform to Section 03 30 00, Structural General Notes and Typical Details, modified by details and notes on drawings.

B. All work shall be inspected as required.

3.05 CONCRETE

A. Project work shall conform to standards as required by the City or County Public Works Agency.

1. Sidewalks shall be scored as indicated, using a sidewalk tool or saw cut, as approved. Cold joints shall be provided at 20 feet on center, maximum. Joint width shall be 1/2". Placement of the joint shall be at corners and with uniform spacing. Placement of filler shall provide for a 1/2" depth for sealant. Finish shall be medium broom, brushed perpendicular to the adjacent property line.

2. Curbs, gutters and accessible ramps shall be formed to the Agency and ADA Standards. Cold joints shall align with those in the sidewalks. Surface finish shall be concrete paving and concrete finish in POT to have heavy broom finish at slope exceeding 6% and medium finish at slopes up to 6%.

3. Concrete finish on P.O.T. shall be medium broom finish for slopes $\leq$ 6% and heavy broom finish for slopes $>$ 6%. Other finishes shall be light broom.

3.05 DEFECTIVE WORK

A. Work of this Section, which does not conform to the line and grade, indicated, does not conform to the reviewed sample panel and work that is not smoothly

and precisely finished, shall be defective. Defective work shall be promptly removed from the site and replaced, at no additional expense to the Owner.

B. On-site work shall conform to PWC standards and shall have score lines, color and finish as specified in the Architectural plans and details.

END OF SECTION