

# **PROJECT MANUAL**

**FOR**

**NEW VEHICLE MAINTENANCE FACILITY AT  
SAN GABRIEL HIGH SCHOOL**

**Alhambra Unified School District**

Prepared by:

**FLEWELLING & MOODY, INC.**

architecture – planning – interiors

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**DSA 03-121009; File No. 19-H1**

**FLEWELLING & MOODY PROJECT NO. 2868.0200**

**July 28, 2023**

**NEW VEHICLE MAINTENANCE FACILITY AT  
SAN GABRIEL HIGH SCHOOL  
ALHAMBRA UNIFIED SCHOOL DISTRICT  
F&M PROJECT # 2868.0000**

**OWNER:  
(DISTRICT OFFICE)**

**Alhambra Unified School District**  
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**END OF DIRECTORY**

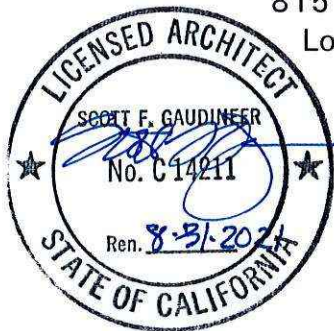
# PROJECT MANUAL

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For

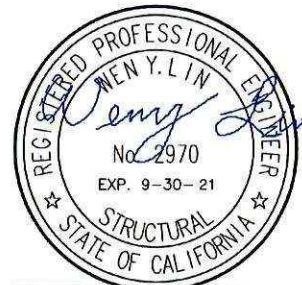
**ALHAMBRA UNIFIED SCHOOL DISTRICT**  
**Alhambra California**

Prepared by  
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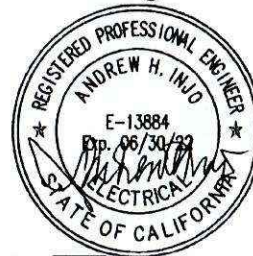
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Project No. 2868.0000

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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. Work under separate contracts.
4. Access to site.
5. Coordination with occupants.
6. Work restrictions.
7. 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: San Gabriel High School

1. Project Location: 801 S. Ramona St., San Gabriel, CA 91776.

B. Owner: Alhambra Unified School District

1. Owner's Representative: Keith Matsuo, Director of Construction.

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. Site preparation, grading, drainage, and new pavement.
2. Construction of new foundation for prefabricated Steel Building.
3. Erection and assembly of prefabricated Steel Building.
4. Interior tenant improvements including Heating, Ventilation electrical, plumbing, and low voltage.

- 5. Associated sitework.

#### 1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.5 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, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 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.

#### 1.6 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will not occupy the premises during entire construction period. Adjacent site is elementary school 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 hours' 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.

## 1.7 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 Pasadena.
- 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 than two days in advance of proposed disruptive operations.
  2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor air intakes.
- F. Controlled Substances: Use of tobacco products and other controlled substances on the Project site is not permitted.

## 1.8 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 1 General Requirements: Requirements of Sections in Division 1 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. None required.

**PART 2 – PRODUCTS**

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 District'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 by Addenda and Construction Change Directives (CCDs) 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 be 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**

1.01 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.

1.02 SUBMITTALS

- A. Request for District's consent:
  - 1. Prior to cutting which affects structural safety, submit written request to the Project Manager 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 Manager and secure his written permission and the required Change Order prior to proceeding.
  
- B. Notices to District Project Manager:
  - 1. Prior to cutting and patching performed pursuant to the District's instructions, submit cost estimate to the Project Manager. Secure the Project Manager's approval of cost estimates and type of reimbursement before proceeding with cutting and patching.
  - 2. Submit written notice to the Project Manager designating the time the Work will be uncovered, to provide for the District's observation.

### 1.03 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**

### 2.01 MATERIALS

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

### 2.02 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**

### 3.01 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.

### 3.02 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.

### 3.03 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. 2019 Building Standards Administrative Code, Title 24 C.C.R.
4. 2019 California Building Code (CBC), Title 24 C.C.R.; (2018 International Building Code of the International Code Council, with California Amendments)
5. 2019 California Electrical Code (CEC), Title 24 C.C.R.; (2016 National Electrical Code of the National Fire Protection Association, NFPA with California Amendments)
6. 2019 California Mechanical Code (CMC), Title 24 C.C.R.; (2018 IAPMO Uniform Mechanical Code with California Amendments)
7. 2019 California Plumbing Code (CPC), Title 24 C.C.R.; (2015 Edition IAPMO Uniform Plumbing Code with California Amendments)
8. 2019 Energy Code (CEC), Title 24 C.C.R.
9. 2019 California Historical Building Code, Title 24, C.C.R
10. 2019 California Fire Code (CFC), Title 24, C.C.R. (2018 International Fire Code of the International Code Council with California Amendments)
11. 2019 California Existing Building Code, Title 24 C.C.R (2018 International Existing Building Code of the International Code Council with California Amendments)
12. 2019 California Green Building Standards Code (CalGreen) Title 24, C.C.R
13. 2019 California Referenced Standards Code, Title 24, C.C.R.
14. 2019 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 2019 Edition
2. NFPA 2001 Clean Agent Fire extinguishing Systems 2015 Edition  
Reference code section for NFPA Standards – CBC (SFM) 3504.1
3. NFPA 13 Automatic Sprinkler Systems 2016 Edition
4. NFPA 14 Standpipe Systems 2013 Edition
5. NFPA 17 Dry Chemical Extinguishing Systems 2013 Edition
6. NFPA 17A Wet Chemical Extinguishing Systems 2013 Edition
7. NFPA 20 Stationary Pumps 2013 Edition
8. NFPA 24 Private Fire Service Mains 2016 Edition
9. NFPA 72 National Fire Alarm Code (California Amended) 2016 Edition  
(Note see UL Standard 1971 for “Visual Devices”)
10. NFPA 80 Fire Door & Windows 2016 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 having 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 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 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

- FS (See 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 mock-ups 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 reinspecting.
- 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 product 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 reinspecting 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/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, 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 reinspecting corrected work.

## ***PART 2 - PRODUCTS (Not Used)***

## **PART 3 - EXECUTION**

### 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 29  
TESTING AND INSPECTION**

**1.01 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.

**1.02 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) 2018 Edition.

**1.03 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.

#### 1.04 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.

#### 1.05 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.

## 1.06 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:

### 42. 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) 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.

(6) 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.

(7) 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.

(C) 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.

1.07 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.

1.08 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 Applicable)

**PART 3 - EXECUTION**

3.01 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.

3.02 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.

3.03 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.

### 3.04 REQUIRED TESTING

Tests and inspections for the following items, where applicable, will be required in accordance with referenced Sections/Chapters of California Building Code, 2019 Edition, Title 24, Part 2:

A. FOUNDATIONS & RETAINING WALL:

1. INSPECTION:

- |    |   |         |
|----|---|---------|
| a. | Inspection of Driven Deep Foundations       | 1704A.8 |
| b. | Inspection of Cast-In-Place Deep Foundation | 1704A.9 |

B. CONCRETE (Chapter 19A)

1. MATERIALS:

- |    |                                 |                       |
|----|---------------------------------|-----------------------|
| a. | Portland Cement                 | 1704A.4.1;<br>1916A.1 |
| b. | Concrete Aggregates             | 1704A.4.1;<br>1903A.3 |
| c. | Shotcrete Aggregates            | 1913A.3               |
| d. | Reinforcing Bars                | 1704A.4.1;<br>1916A.2 |
| e. | Pre-stressing Steel & Anchorage | 1704A.4.1;<br>1916A.3 |

2. QUALITY:

- |    |                            |                                 |
|----|----------------------------|---------------------------------|
| a. | Proportions of Concrete    | 1905A.2;<br>1905A.3;<br>1905A.4 |
| b. | Strength Tests of Concrete | 1905A.1.1;<br>1905A.6           |
| c. | Shotcrete Proportions      | 1913A.2                         |

	d.	Shotcrete Cores	1913A.5
	e.	Composite Construction Cores	1916A.4
	f.	Gypsum Concrete Strength Tests	1914A; 1916A.6
3.		INSPECTION:	
	a.	Job Site	1905A.7
	b.	Batch Plant	1704A.4.2
	c.	Waiver of Batch Plant	1704A.4.3
	d.	Prestressed Concrete	1704A.4.4
	e.	Shotcrete	1704A.17; 1913A
	f.	Reinforcing Bar Welding	1903A.7; Table 1704A.3
	g.	Post-Installed Anchors in Concrete	1916A.7
C.		LIGHT WEIGHT METALS	
1.		MATERIALS	
	a.	Alloys	2002.1
	b.	Identification	2002.1
2.		INSPECTION	
	a.	Welding	2003.1
D.		MASONRY	
1.		MATERIALS	
	a..	Masonry units	2103A.1
	b.	Portland cement, lime	2103A
	c.	Mortar and grout aggregates	2103A.8; 2103A.12; 2103A.12.3
	d.	Reinforcing bars	2103A.13
2.		QUALITY	
	a.	Portland cement tests	1916A.1

	b.	Mortar and grout tests	2105A.2.2.1.4
	c.	Masonry prism test	2105A.2.2.2
	d.	Masonry core tests	2105A.4
	e.	Masonry Unit Test	2105A.2.2.1
	f.	Reinforcing bar tests	1916A.2
3.		INSPECTION	
	a.	Reinforced masonry	1704A.5
	b.	Reinforced Bar Welding	1704A.3.1.3; 1903A.7
E.		STRUCTURAL STEEL	
1.		MATERIALS	
	a.	Structural Steel	2205A.1
	b.	Cold Form Steel	2209A.1
	c.	Identification	2203A.1
2.		QUALITY	
	a.	Tests of Structural and Cold Form Steel	2210A.1
	b.	Tests of High Strength Bolts, Nuts, Washers	2212A.1
	c.	Tests of End Welded Studs	2212A.2
	d.	Steel Joists	2206A; 1704A.3.2.1
	e.	Non-Destructive Weld Tests	1704A.3.1
3.		INSPECTION	
	a.	Shop Fabrication	1704A.2; 1704A.3
	b.	Welding	1704A.3.1
	c.	Nelson Stud Welding	1704A.3
	d.	High Strength Bolt Installation	1704A.3.3
F.		WOOD	
1.		MATERIALS:	
	a.	Lumber and plywood	2303.1
	b.	Glued Laminated Members	2303.1.3

2. INSPECTION:

- |    |                             |                                       |
|----|-----------------------------|---------------------------------------|
| a. | Glued Laminated Fabrication | 1704A.6.3.1;<br>2303.1.3              |
| b. | Timber Connectors           | 1704A.6.4                             |
| c. | Manufactured Trusses        | 1704A.6.2;<br>1704.6.3.2;<br>2303.4.7 |

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.

## 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, proofrolling, 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 weathertight 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 58 13  
TEMPORARY PROJECT SIGNAGE**

**PART 1 – GENERAL**

1.01 PROJECT IDENTIFICATION

- A. Provide two 32 square foot Project Identification signs of wood frame and exterior grade plywood construction, painted, with exhibit lettering by professional sign painter, to District's design and colors as indicated on Drawings.
1. Confer with District for confirmation of names prior to lettering signs.
  2. Ground Clearance: Two feet.
  3. Materials: ½" MDO panel or exterior grade plywood panel with vertical structural members of 4x8 #2 creosote treated Douglas fir installed to depth of 4 feet below grade.
    - a. Stringers: 2x2 stingers of dense #1 Douglas fir, located behind top, bottom, and center of sign panel.
  4. Paint: Sign panel and structural members shall be painted on all sides and edges with two coats of exterior type alkyd paint over suitable primer and professionally lettered or silk screened.
  5. Typefaces: Optima.
  6. Seal: Obtain from District. Coordinate with Project Manager.
- B. Erect one sign at each street front site at locations established by District. Position parallel with street and locate in areas which will not interfere with construction activities.
- Signs: Remain on site until the buildings permanent exterior signing is installed, or as otherwise directed by the District.
- No other signs shall be permitted.
- C. Signs shall include the following:
1. Name of the School
  2. Title of Project.
  3. Rendering of the Project
  4. Seal of the District.
  5. Logo of Measure TT Program
  6. Logo/Name of the Architect
  7. Logo/Name of the Contractor
- D. The project sign must be erected within 35 calendar days after Notice of award of this contract.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

END OF SECTION

**SECTION 01 60 20  
STORAGE AND PROTECTION**

**PART 1 – GENERAL**

1.01 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.

1.02 QUALITY ASSURANCE

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

1.03 MANUFACTURERS' RECOMMENDATIONS

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

1.04 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.

1.05 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.

1.06 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.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

END OF SECTION

**SECTION 01 77 00  
CLOSEOUT PROCEDURES**

**PART 1 – GENERAL**

1.01 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.

1.02 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.

### 1.03 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.

### 1.04 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.

### 1.05 ADJUSTING

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

### 1.06 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.

## 1.07 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 installer's 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.

#### 1.08 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.

## 1.09 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.

#### **PART 2 – PRODUCTS (Not Used)**

#### **PART 3 – EXECUTION (Not Used)**

END OF SECTION

**SECTION 01 77 01  
PROJECT CLOSEOUT**

**PART 1 – GENERAL**

1.01 REFERENCE

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

1.02 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 Exhibit K.
  - 2. Close-out Submittals: See Respective Spec. Sections.

1.03 PREFINAL INSPECTION; SUBSTANTIAL COMPLETION

- A. Prefinal Inspection:
  - 1. Upon "substantial completion" of the Work, Contractor shall notify Architect and request a "prefinal 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.

1.04 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.

1.05 GUARANTEES

- A. General: Contractor shall guarantee in writing to District that:
- B. 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.

- C. Format: Contractor shall submit guarantees typed in the format indicated in "Guarantee Form", See General Conditions Exhibit K.
- D. Number of Copies: Submit in duplicate to Architect.
- E. Required Guarantees:
  - 1. 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.
  - 2. General Guarantee:
    - a. By General Contractor; For The Entire Work: 1 Year

#### 1.06 WARRANTIES

- A. General: Submit all warranties required by various Spec. Sections.

#### 1.07 CERTIFICATES

- A. General: Submit all certificates and Verified Reports required by various Spec. Sections or listed herein, notarized as required.

#### 1.08 OPERATION & MAINTENANCE DATA

- A. General: Submit all manuals required by various General Conditions, Spec. Sections or listed herein; two copies each.

#### 1.09 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.

**PART 2 – PRODUCTS (Not Used)**

**PART 3 – EXECUTION (Not Used)**

END OF SECTION

**SECTION 01 77 20  
PROJECT RECORD DOCUMENTS**

**PART 1 – GENERAL**

**1.01 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, SUBMITTALS AND SUBSTITUTIONS.

**1.02 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.

**1.03 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.

**1.04 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**

### **2.01 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 mylars and CAD disk, the Contractor shall provide the actual JOB SET (“marked-up bluelines”) referenced above to the District at the completion of construction, which will remain the District’s property.

## **PART 3 – EXECUTION**

### **3.01 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.

### 3.02 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.

### 3.03 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**

1.01 SUBMITTAL REQUIREMENTS

- A. Assemble Warranties and Service and Maintenance Contracts, executed by each of the respective Manufacturers, Suppliers, and Subcontractors.

Number of original signed copies required: Four (4) each.

Table of Contents: Neatly typed in orderly sequence.

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.

1.02 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.

**PART 2 – PRODUCTS (NOT USED)**

**PART 3 – EXECUTION (NOT USED)**

END OF SECTION

**SECTION 01 78 23  
OPERATION AND MAINTENANCE MANUALS**

**PART 1 – GENERAL**

1.01 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.

1.02 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**

2.01 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**

#### **3.01 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.

### 3.02 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.

### 3.03 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.

### 3.04 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**

1.01 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:
  - 2. Section 31 10 00: Site Clearing

1.02 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 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.

### 1.03 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.

### 1.04 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.

### 1.05 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.

#### 1.06 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

### 2.01 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 than 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.
  1. 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.

2. 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.
- D. 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.
  - E. 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.

## 2.02 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

### 3.01 GENERAL

- A. Protection:
  1. Do not begin demolition until safety partitions, barricades, warning signs and other forms of protection are installed.
  2. Provide safeguards, including warning signs, lights and barricades, for protection of occupants and the general public during demolition.
  3. Provide and maintain fire extinguishers. Comply with requirements of governing authorities.
  4. 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 02831: 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.

### 3.02 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.
  - 5. Do not commence demolition operations until associated disconnections have been completed.
  - 6. 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.
  - 7. Should a utility line or structure be damaged, immediately notify the responsible utility company or agency and notify Owner's Representative and Architect.
    - a. Repair or replace all damaged utility lines and structures as directed by the responsible utility company or agency.

- b. Repair or replacement of damaged utility lines and structures whose 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).

### 3.03 EXPLOSIVES

- A. Explosives: Use of explosives will not be permitted.

### 3.04 DEMOLITION

- A. Demolition, General:
  - 1. With certain exceptions, the Contractor shall raze, remove and dispose of all buildings and foundations, 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.

### 3.05 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.

### 3.06 CLEANING

- A. Clean existing materials to remain, using appropriate tools and materials.
- B. Protect adjacent materials and equipment during cleaning operations.

### 3.07 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.

### 3.08 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.

### 3.09 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 30 00  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement.
- D. Welding certificates.
- E. Material certificates.
- F. Material test reports.
- G. Floor surface flatness and levelness measurements.

1.3 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- F. Pre installation Conference: Conduct conference at Project site

- G. Tests for Concrete Materials at Batch Plant: Utilizing batch plant test records, perform the following tests in accordance with provisions of the building code:
1. Cement: Sample and test cement, or provide mill test reports, as accepted, certifying that the cement conforms to the requirements of this specification.
  2. Aggregate:
    - a. Sample and test concrete aggregate for grading and soundness before concrete mix designs are established.
    - b. Test aggregate for shrinkage characteristics in accordance with ASTM C 157.
    - c. Conduct petrographic examinations of aggregate proposed for use in accordance with ASTM C 295.
  3. Air Content: ASTM C 173, volumetric method or ASTM C 231, pressure method. One test for each set of compressive strength test specimens.

## **PART 2 - PRODUCTS**

### **2.1 FORM-FACING MATERIALS**

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

### **2.2 STEEL REINFORCEMENT**

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.
- D. Galvanized-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from galvanized-steel wire into flat sheets.
- E. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice.

## 2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type II, gray.
- B. Normal-Weight Aggregates: ASTM C 33, graded.
  - 1. 1. Maximum Coarse-Aggregate Size: No larger than three-fourths of the clear space between reinforcing bars or between reinforcing bars and forms, nor larger than one-fifth of the narrowest dimension between sides of forms, nor larger than one-third of the depth of slab. 1-inch maximum aggregate may be used in other than mass concrete. 1 ½-inch maximum aggregate may be used in mass concrete where reinforcement clearance will permit.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

## 2.4 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

## 2.5 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

## 2.6 VAPOR BARRIER

- A. Sheet Vapor Barrier: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC or approved equal.
- B. Sheet Vapor Barrier: Polyethylene sheet, ASTM D 4397, not less than 15 mils (0.25 mm) thick. Permeance of less than 0.01 perms per ASTM F 1249 or ASTM E 96.
- C. Sheet Vapor Barrier Location: Concrete slab to be placed directly on the vapor barrier.
- D. Sheet Vapor Barrier Installation:

## 2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

## 2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

## 2.9 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Comply with ACI 318 Sec 3.6
- B. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 2. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
- D. Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3000 psi (24.1 MPa) at 28 days.

2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.5 lb/cu. yd. (0.90 kg/cu. m)
6. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

#### 2.10 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

#### 2.11 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

### **PART 3 - EXECUTION**

#### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Do not chamfer exterior corners and edges of permanently exposed concrete.

#### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.3 VAPOR BARRIERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor barrier to comply with ASTM E 1643. Follow manufacturer instructions for placement (including laps, sealing around penetrations and foundation walls), protection and repair. Provide reinforcement supports that do not puncture the vapor barrier. Place vapor barrier sheeting with the longest dimension parallel with the direction of the concrete pour.
  - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor barrier. Repair damage and reseal vapor barrier before placing concrete.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect. Comply with ACI 318 Sec 6.4.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. When not shown on drawings locate not more than twenty five feet on center. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Sawcutting to occur within 18 hours of finishing.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- E. Waterstops: Install in construction joints and at other joints according to manufacturer's written instructions.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  2. Comply with ACI 318 Sec 5.10
- C. Cold-Weather Placement: Comply with ACI 306.1.
- D. Hot-Weather Placement: Comply with ACI 301.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

Apply to concrete surfaces exposed to public view and/or to receive a rubbed finish.

- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighthen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic, porcelain or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/8 inch (3.2 mm)**.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
1. After floating, draw broom across the surface at right angle to flow of traffic producing a uniform non-skid surface. For light broom finish, draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture. For medium broom finish, use a fiber broom, leaving depressions approximately 1/16" deep. For heavy broom finish, use a coarse broom leaving depressions approximately 1/8" deep. Use liquid curing membrane.
  2. At sloped surfaces, provide medium broom finish for slopes 6% or less and heavy broom finish for slopes greater than 6%.

### 3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (**1 kg/sq. m x h**) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Comply with ACI 318 Sec 5.11. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.
  2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (**300 mm**), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.



3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

Curing and Sealing Compound: Apply uniformly to floors and slabs in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period. Acceptable manufacturers include "#1100 Clear" as manufactured by W.R. Meadows, Inc. ; "Curetox" as manufactured by Toch Brothers, Inc., or "Kure-N-Seal", manufactured by Sonneborn Building Products.

### 3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Corrective work: Grinding (if needed) shall be done dry with a vacuum attachment. Ensure any patching materials that are used are compatible with the flooring adhesive to be used.

### 3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports. Comply with Sec. 01-45-29.

END OF SECTION

**SECTION 05 12 00  
STRUCTURAL STEEL**

**PART 1 – GENERAL**

1.1 SCOPE

- A. Requirements of Division 1 apply to this Section.
- B. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the Contract, including, but not limited to, these major items:
  - 1. All structural steel framing, including plates and channels.
  - 2. Base plate and furnishing anchor bolts.

1.2 RELATED WORK SPECIFIED ELSEWHERE AS REQUIRED

- A. Miscellaneous metalwork.
- B. Setting anchor bolts and grouting base plates.

1.3 GENERAL REQUIREMENTS

- A. Codes: All work to conform to Chapter 22A of Title 24, of the California Building Code latest Edition, and Chapter 22A, of UBC latest edition.
- B. Shop Drawings: In accordance with section 01 33 00, submit complete checked shop drawings as required for this work.
  - 1. Improper Corrections: Should the Architect, in reviewing shop drawings, make corrections that would cause incorrect fitting or reduced strength, give written notice of such fact at once, so that the correction may be modified before the work affected is started.
  - 2. As-Built Drawings: After this work has been erected, correct or revise the originals of the reviewed shop drawings and erection diagrams to correspond with field changes.
- C. Test and Inspections: The Owner will pay for all tests and inspections of completed installation of this work. Costs of all tests and inspections at materials sources, and costs of retests of rejected work, shall be borne by the Contractor. Arranging for scheduling of tests and inspections shall be the responsibility of the Contractor. See Section 01 45 29 for testing requirements.

**PART 2 – PRODUCTS**

2.1 MATERIALS

- A. Materials: New tested stock of domestic manufacture, complying with standard specifications hereinafter referenced. If foreign materials are used, they shall meet or exceed the requirements of all authorities having jurisdiction.
- B. Machine Bolts: A307, and ANSI B18.2, 36 square or hexagonal heads.

- C. Paint: Use primer as specified under Painting Section.
- D. Structural Pipe Columns: ASTM A53, Type S, Grade B.
- E. Grout: "Por-Rok" as manufactured by Minwax Construction Products Division.
- F. Structural Tubes: ASTM A500, Grade B.
- G. Arc-Welding Electrodes: Conform to requirements of AWS; as required for the conditions of intended use.
  - 1. All welds on members comprising the Seismic-Force-Resisting System, except as noted below for joining of material conforming to ASTM A913, grade 65, shall employ weld filler metals classified for nominal 70 psi tensile strength, referred to as E70 electrodes, meeting the following minimum mechanical property requirements:
    - a. CVN toughness of 20 ft-lb at 0°F, using AWS A5 classification test methods
    - b. CVN toughness: 40 ft-lb at 70°F.
    - c. yield strength: 58 ksi minimum, using both the AWS A5 classification test (for E70 classification electrodes).
    - d. tensile strength: 70 ksi minimum, using both the AWS A5 classification test (for E70 classification electrodes).
    - e. Elongation: 22% minimum, using both the AWS A5 classification test.
  - 2. Welded joints of ASTM A913, grade 65 material shall be made with weld fillet metals classified as E80 electrodes with a minimum yield strength of 68 ksi, minimum tensile strength of 80 ksi, and a minimum elongation of 19%. CVN toughness requirements of (1) and (2) above shall apply.
  - 3. Packaging Requirements of weld filler metals shall conform to the requirements of AWS D.1.1. FCAW electrodes shall be received in moisture-resistant packages that are undamaged. They shall be protected against contamination and injury during shipment and storage. Electrode packages shall remain effectively sealed against moisture until the electrode is required for use. When removed from protective packaging and installed on machines, care shall be taken to protect the electrodes and coatings, if present, from deterioration or damage. Modification or lubrication of an electrode after manufacture for any reason is not permitted, except that drying shall be permitted when recommended by the manufacturer.

## 2.2 TESTS

Identified Material: If material is properly identified, mill reports will be accepted.

Unidentified Material: One tension and one bend test for every 20 tons or fractional part thereof. Submit copies of all test reports to the Architect a reasonable time before starting fabrication.

## 2.3 TESTS OF WELDING AND BOLTING

- A. Testing agency shall inspect all shop and field welding, and furnish qualified deputy inspectors, approved by the Architect and Division of the State Architect. Testing and inspection shall comply with all regulations of the Division of the State Architect. Testing agency shall certify in writing, upon completion of the work, that the welding has been performed by fully qualified welders in accordance with drawing and specifications requirements and with all applicable requirements of regulatory agencies having jurisdiction.
- B. Weld Acceptance Criteria
1. Engineer's Authority: Welds or portions of welds that fail to meet the acceptance criteria of AWS D1.1 shall be repaired or replaced.
  2. Magnetic Particle Testing: If a surface discontinuity or near-surface discontinuity, within 1/8 inch of the surface, is detected, the discontinuity shall be rejected and removed. If the separation from the surface cannot be determined, the discontinuity shall be categorized as a surface flaw, rejected and removed.
  3. Ultrasonic Testing - Flaw Detection:
    - a. When ultrasonic testing is required, the joint shall be scanned for flaw detection purposes following the procedures prescribed in AWS D1.1, Annex K, with exceptions as noted below. Joints that fail the acceptance criteria described below may be inspected using the Ultrasonic Testing - Flaw Sizing methods as prescribed in Section 5.8.4 of this specification, or, at the Contractor's option, may be excavated for further investigation and repaired, then reinspected using these Flaw Detection procedures.
    - b. When ultrasonic testing is required, CJP and PJP groove welds shall be scanned for flaw detection. Acceptance criteria shall be as for statically loaded welds in Annex K, Table K-1, of AWS D1.1.
    - c. Joints with backing bars remaining in place shall not be rejected on the basis of indication ratings (db values) from the interfaces between backing bar and base metal or backing bar and weld. The UT Procedure shall prescribe methods for distinguishing between backing bar indications and root discontinuities.
    - d. PJP groove weld joints shall not be rejected on the basis of indication ratings (db values) from the root area of the weld. Notches within the weld, located a distance more than 1/8 inch from the as-welded root, shall be scanned for acceptance using the criteria above.
    - e. Regions of welds adjacent to cope holes may be inspected with multiple probe techniques.
  4. Ultrasonic Testing – Flaw Sizing: Ultrasonic testing for flaw sizing shall be performed following written procedures as required by AWS D1.1, Annex X. When flaw-sizing techniques are implemented, the following acceptance criteria applies to groove welds:
    - a. If a surface flaw or near-surface flaw (within 1/8 inch of the surface) is detected, the flaw shall be rejected and removed. If the separation from the surface cannot be measured, the flaw shall be categorized as a surface flaw, rejected and removed.

- b. When backing bars remain in place, the position of notch tips that extend into the weld metal shall be determined. The notch shall be rejected if it extends greater than 1/8-inch into the thickness of the weld. The weld present between the backing bar and column face shall not be considered a part of the weld thickness in determining the depth of notch or thickness of weld.
- c. Embedded flaws, defined as those that do not come within 1/8 inch of the surface, shall be rejected if their height exceeds 1/4 inch.
- d. Embedded flaws shall be rejected if their area, as calculated by multiplying the maximum discontinuity height by the maximum discontinuity length, exceeds the thickness of the thinner parent metal multiplied by the thickness of the thicker parent metal.
- e. Embedded flaws, either individually or as a group within a length of weld 12 inches or less, shall be rejected if they exceed a total area (the sum of the areas of individual discontinuities) equal to 10% of the thickness of the thinner parent metal multiplied by the weld length. The weld length used for this calculation shall not exceed 12 inches, with longer welds being evaluated in multiple parts.
- f. Aligned discontinuities of lengths L1 and L2 separated by less than  $(L1+L2)/2$  shall be evaluated as continuous.
- g. Parallel discontinuities of heights H1 and H2 separated by less than  $(H1+H2)/2$  shall be evaluated as continuous.

## 2.4 PAINTING

- A. Thoroughly clean structural steel of loose mill scale, grease, dirt and foreign matter, by thoroughly scraping, wire brushing or sandblasting, and apply paint to a dry film thickness of one mil.

## PART 3 - EXECUTION

### 3.1 FIELD MEASUREMENTS

- A. Before starting work obtain measurements pertaining to this work, and verify the locations and exact positions of concrete supports and anchor bolts.

### 3.2 WORKMANSHIP

- A. Workmanship: Equal to the best standard practices in modern structural shops, conforming to applicable provisions contained in the AISC Code of Standard Practice, except where these requirements herein govern.
- B. Injury and Excessive Stress: Transport, handle and erect structural steel, in shop and field, to preclude injury. Do not subject material to excessive stress in any part or connection.
- C. Welded Construction
  - 1. Each welder working on the project shall be assigned an identification symbol or mark. Each welder shall mark or stamp this identification symbol at each weldment completed. Stamps, if used, shall be the low-stress type.

2. Welding personnel shall be qualified in accordance with AWS D1.1, Section 4, Parts X and C. WPQR testing performed more than six months prior to the start of the welding by the welder is acceptable, provided written documentation is submitted showing that the welder has continued to use the applicable welding process on an ongoing basis since the test was conducted, with no lapse in service exceeding six months. Welders whose work routinely exhibits poor workmanship shall be requalified before performing further welding.
3. WPSs shall be available to welders and inspectors prior to and during the welding process. Prior to welding, joint fit-up shall be verified by the welder for conformance with the WPS and AWS D1.1.
4. For all complete joint penetration (CJP) and partial joint penetration (PJP) groove welds subjected to ultrasonic testing (UT), a visible mark, "for UT," shall be accurately placed on the steel a distance of 4 inches away from the root of the edge preparation.
5. Welding shall be performed in accordance with the appropriate WPS for the joint.
6. Groove welds shall be complete joint penetration groove welds, unless specifically designated otherwise on the Drawings. Groove preparation details are at the Contractor's selection, subject to qualification, is required, in accordance with AWS D1.1.
7. Faces of fillet and groove welds exposed to view shall have as-welded surfaces that are reasonably smooth and uniform. No finishing or grinding shall be required, except where clearances or fit of other items may so necessitate, or as preparation for coating.

D. Supplemental Welding Personnel Testing and Qualification Period.

1. Welders and welding operators shall pass Supplemental Welder Qualification Testing, as prescribed in Appendix B, on special test joint mock-ups. Testing shall be performed using the process to be used in the work, with the WPS set at the highest deposition rate to be used in the work. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification. Tack welders need not perform such Supplemental Testing.
2. Welding personnel required to be tested using the Supplemental Welding Personnel Testing prescribed in Section 3.3.1.1 shall be qualified by test within 12 months prior to beginning welding on the project.
3. Should the 12-month period elapse during welding on the project, the Supplemental Welder Qualification remains valid. It is not required to repeat the testing during the course of the project, unless the quality of the workmanship for that welder routinely fails to meet the applicable project weld quality standards.

E. Welding Sequence for Moment Connection of Bottom Beam Flange.

1. When welding the bottom flange to the column flange of welded moment-resisting connections, the following sequence shall be followed:
  - a. When welding from Side A (one side of the beam), the root pass shall begin beyond the center of the joint on Side B, reaching past the beam web (or web plate, for FF connections) through the weld access hole (or opening, for FF connections). After the arc is initiated, travel shall progress toward the edge of the Side A beam flange, and the weld shall be terminated on the Side A weld tab.

- b. The Side A root pass, and the root pass deposit on Side B, shall be thoroughly cleaned and visually inspected by the welder to ensure fusion, soundness, and freedom from cracks, slag inclusions and excessive porosity. The resulting bead profile shall be suitable for obtaining good fusion by the subsequent root pass to be initiated from Side B. If the profile is not conducive to good fusion, the start of the first root pass shall be ground, gouged, chipped, or otherwise prepared to ensure adequate profile to achieve fusion.
  - c. The second half of the weld joint, from Side B, shall have the root pass applied before and other weld passes are performed. The arc shall be initiated in the area of the start of the first Side A root pass, and travel shall progress to the end of the joint, terminating of the Side B weld tab.
  - d. The above sequence shall be repeated for subsequent weld layers, and each weld layer shall be completed on both sides of the joint before a new layer is deposited. The order of operations (Side A, then Side B, or vice versa) is not restricted and may vary for each weld layer.
2. Weld passes shall be placed in horizontal layers. Each pass shall be thoroughly cleaned of slag and wire brushed. Each pass shall be inspected by the welder, as described above in Step 2.
  3. Both top and bottom beam flanges should be completely welded prior to any supplemental welding to the beam web or shear tab, unless otherwise detailed in the approved erection plan and the WPS.

### 3.3 FABRICATION AND ASSEMBLY

Before being fabricated or worked, material shall be thoroughly wire brushed, cleaned of loose mill scale and rust, and straightened by methods that will not injure it. After punching or working the component parts of a member, remove twists or bends before the parts are assembled. Finished members shall be free from twists, bends, and open joints when erected.

Field Joining: Members and sections shall be of sizes, weights, shapes, and arrangements indicated, closely fitted, and finished true to line and in precise position necessary to allow accurate erection and proper joining of parts in the field. Drifting to enlarge unfair holes will not be allowed. Rolled sections, except for minor details, shall not be heated without prior approval.

Contact: Component parts of built-up members shall be well pinned and rigidly maintained in close contact using clamps or temporary bolting during welding. Compression joints depending upon contact bearing shall have bearing surfaces accurately milled perpendicular to their axes, or as detailed.

- A. In addition to special care used to handle and fabricate AESS, comply with the following:
  1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes.
  2. Grind sheared, punched, and flame-cut edges smooth
  3. Fabricate with exposed surfaces free of mill marks.
  4. Fabricate with exposed surfaces free of seams to maximum extent possible.
  5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
  7. Fabricate to the tolerances specified in AISC 303 for steel that is designated AESS.
  8. Seal-weld open ends of hollow structural sections with 3/8-inch (9.5-mm) closure plates.
- B. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch (3.2 mm) with a tolerance of 1/32 inch (0.8 mm)

### 3.4 GAS CUTTING

- A. When permitted by the Architect, use of a cutting torch is allowed where the metal being cut is not carrying stress during the operation, and provided stresses will not be transmitted through a flame-cut surface. Make gas cuts smooth and regular in contour. To determine the effective width of members so cut, deduct 1/8" from the width of the gas cut edges. Make the radius or re-entrant gas cut fillets as large as practicable, but in no case less than one inch.

### 3.5 PUNCHING, DRILLING AND REAMING

- A. Material may be punched 1/16" larger than the nominal diameter of the bolt for standard bolt holes. Holes for anchor bolts are oversized to facilitate erection as follows:

Bolts	3/4" to 1"	5/16" oversize
	1" to 2"	1/2" oversize
Bolts over 2"		1" oversize

- B. Holes shall be drilled or sub-punched or reamed. The diameter for sub-punched holes, and the drill for sub-drilled holes, shall be 1/16" smaller than the nominal diameter of the bolt to be accommodated. Precisely locate finish holes to insure passage of bolts through assembled materials without drifting. Poor matching of holes is sufficient cause for rejection.

### 3.6 WELDING

- A. Welding and Welded Joints: Detail and execute in accordance with the requirements of the American Welding Society standards and as modified by AISC Specifications or as detailed and noted on the drawings. In the event of conflict, the notes and details on the drawings take precedence. Structural welding shall be done by Low Hydrogen, CO<sub>2</sub>, Innershield or Submerged Arc.
- B. Electrode Storage and Exposure Limits.
1. FCAW electrodes shall be receive and stored in the original, undamaged manufacturer packaging, until ready for use. Electrodes in packages that have had the internal plastic wrapping damaged shall not be used. Modification or lubrication of an electrode after manufacture is not permitted, except that drying is permitted as recommended by the manufacturer.
  2. When welding is to be suspended for more than 8 hours, electrodes shall be removed from the machines and stored in an electrode wire oven maintained at a temperature between 250o and 550o F, or as recommended by the manufacturer. Electrodes not consumed within 24 hours of accumulated



exposure outside closed or heated storage shall not be used. Electrode spools shall be identified to facilitate monitoring of total atmospheric exposure time. FCAW electrodes that have been exposed for periods exceeding an accumulated 24 hours may be dried if manufacturer's testing and recommendations show that drying is effective at removing moisture and restoring electrodes to their designated diffusible hydrogen level.

C. Minimum Preheat and Interpass Temperature.

1. Minimum preheat and interpass temperatures shall be provided for all welds, including tack welds, in accordance with AWS D1.1, Table 3.2. The Contractor may specify higher minimum temperatures, if desired, as a part of the Contractor's WPS for a particular application. In such cases, the WPS minimum reheat and interpass temperatures shall be provided.
2. Preheat and interpass temperatures lower than those required by AWS D1.1, Table 3.2, are permitted provided the WPS has been qualified by test, and the WPS and PQR have been accepted by the Engineer.
3. Minimum preheat and interpass temperatures shall be verified at a distance of 3 in. from the weld, at the joint of arc initiation or for materials over 3 inches in thickness at a distance equal to the thickness of the part.

D. Maximum Preheat and Interpass Temperature

1. The maximum preheat and maximum interpass temperature permitted is 550oF, measured at a distance of 1 in. from the point of arc initiation. This maximum temperature may not be increased by the WPS, regardless of qualification testing.

E. Backing Bar and Weld Tab installation and removal specifications and requirements are shown on the Structural drawings.

### 3.7 ERECTION

- A. Erect structural steel by professional riggers, carefully plan and lay out so that a minimum of cutting will be necessary. Erect the work plumb, square and true to line and level, and in precise positions as indicated. Provide temporary bracing and guys wherever necessary to provide for loads and stresses to which the structure may be subjected including those due to erection equipment and its operations, and leave in place as long as necessary to safeguard all parts of the work.
- B. Temporary Connections: As erection progresses, the work shall be securely bolted up as necessary to maintain the steel in proper position while field bolting and welding is being done, and as necessary to take care of dead loads, wind, and erection stresses. No field welding or high strength bolting shall be done until the work has been properly aligned, plumbed and leveled.
- C. Set column base plates in exact position, as to alignment, level, and elevation, as well as support on steel wedges, or equivalent until the grout thereunder has thoroughly set. The center of each base shall be true to the column center within 1/16". Adjust elevation to  $\pm 1/32$ ". Exactly level plates on both axes.
- D. Sequence: Carry out the erection of structural steel in proper sequence with the work of other trades. Frame, bed, and anchor to the concrete and related work in accordance with detailed drawings and reviewed setting diagrams.

- E. Erection Tolerance: In accordance with the current AISC Code or Standard Practice for Steel Buildings and Bridges.

### 3.8 ANCHOR BOLTS

- A. Furnish to the site when and as required to maintain job progress, for installation under Concrete Section, all anchor bolts to be embedded in the concrete for the securing of structural steel in position. Provide the necessary drawings and templates for the setting of such anchor bolts in the concrete forms. Be jointly responsible with others for the proper location, and installation, and make good deficiencies and errors. Setting of anchor bolts in hardened concrete, necessitated through error or oversight, shall be made under direction of the Architect in suitably drilled holes solidly grouted in place, embedded in an approved structural epoxy.

### 3.9 GROUTING OF BASES AND PLATES

- A. Be responsible for maintaining bases and bearing plates in proper location and in proper level while they are being grouted and be jointly responsible for a perfect job. Refer to Concrete Section for materials, mix and procedures for grouting of base plates.

### 3.10 CUTTING STRUCTURAL STEEL

- A. Provide cuts in structural steel for mechanical, plumbing and electrical pipes as approved by Architect. Locate as shown on Mechanical, Plumbing and Electrical drawings.

### 3.11 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
  2. Fill vent and drain holes that will be exposed in the finished work, unless indicated to remain as weep holes, by plugging with zinc solder and filling off smooth.
  3. Galvanize attached to structural-steel frame and located in exterior walls.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

**END OF SECTION**

**SECTION 05 40 00  
LIGHT GAUGE STEEL FRAMING SYSTEM**

**PART 1 – GENERAL**

- A. Requirements of Division 1 apply to this Section.
- 1.01 DESCRIPTION
- A. Steel framing systems as indicated on the drawings and specified herein.
- 1.02 RELATED WORK SPECIFIED ELSEWHERE AS REQUIRED
- A. Rough Hardware - Rough Carpentry.
- 1.03 SUBMITTALS
- A. Submit a materials list, indicating structural values and conformance with governing standards in conformance with Section 01 33 00.
- 1.04 REFERENCED STANDARDS
- A. All work shall conform to latest edition of the California Building Code, California Code of Regulations, Title 24, Chapter 22A
  - B. American Welding Society (AWS) Structural Welding Code (D1.3). Specification for Welding Sheet Metal in Structures (E1.3).
  - C. American Iron and Steel Institute (AISI) Cold Formed Steel Design Manual, "Spec for the Design of Cold Formed Steel Structural Members, latest edition.

**PART 2 – PRODUCTS**

- 2.01 STUDS, TRACK, BRACING BRIDGING AND JOISTS.
- A. Size, type and thickness as indicated on the drawings.
  - B. Steel Stud and Track Member: "C" flange type, ASTM A653 SS Grade 33 or ASTM A1011 SS Grade 33 - rust - inhibitive primed.
  - C. Steel-16 Gauge and Heavier: Conform to ASTM A653 SS Grade 50, Class 1 or 3 or ASTM 1011 SS Grade 50 and as set forth in Section A3.1 of referenced AISI Spec.
  - D. Steel-18 Gauge: Conform to ASTM A653 SS yield 33 ksi and as set forth in Section A3.1 of referenced AISI Spec.
  - E. Steel-20 Gauge: Conform to ASTM A653 SS, yield 33 ksi and as set forth in Section A1.2 of referenced AISI Spec.
  - F. Paint: Use primer as specified in Painting Section.
  - G. Welding Electrodes: AWS AS.1.
  - H. Stud Channel: Non-bearing locations only: 20 gauge.

## 2.02 FASTENERS

- A. Fasteners shall be the size and type indicated on the drawings. Note that the materials indicated are manufactured by S SMA, ICBO ER-4943P. Similar materials which will meet the fastening requirements of each detail may be acceptable substitutes. Minimum finish: Cadmium or zinc plating per ASTM A-165 Type NS.
- B. Since proper installation and load transfer is dependent on depth and pressure sensitive drive equipment, fasteners shall be the products of one manufacturer; recommended washers and other accessories as well as recommended drive equipment shall be required.

## 2.03 COLD ROLLED CHANNELS

- A. Fabricated from 16 ga. sheet.
- B. Provide galvanized finish for use in conjunction with galvanized framing and in exterior surfaces.
- C. Provide painted finish for use in generally dry interior areas.
- D. Depths.
  - 1. 1 1/2" minimum for bridging and for miscellaneous framing.
  - 2. Provide deeper channels as required by span and load.
  - 3. Provide deeper channels when so indicated.

## 2.04 MISCELLANEOUS COLD AND HOT ROLLED SHAPES

- A. Square or Rectangular Steel Tubing: Steel conforming to ASTM A500, Grade B.
- B. Round Steel Tubing: Steel conforming to ASTM A53, Type E or S, Grade B.
- C. Angles, Channels, Etc.: Steel conforming to ASTM A36.

## 2.05 BOLTS, NUTS, WASHERS

- A. Steel conforming to ASTM A307.
- B. Provide headed bolts for embedment in concrete and masonry.
  - 1. Minimum headed bolt size, 5/8" diameter with 6" embedment unless indicated otherwise.

## 2.06 EXPANSION ANCHORS

- A. Hilti Fastener Systems "Kwik Bolt" wedge expansion anchors, or acceptable equivalent by Simpson, Ramset or Rawl. Minimum size 5/8" unless indicated otherwise.

## 2.07 POWDER ACTUATED FASTENERS (LOW VELOCITY)

- A. Fastener Tool: Hilti Fastener Systems powder actuated, piston driven installation tool, or acceptable equivalent, model as required for fastener pin as indicated or specified.
- B. Fastener Pins
  - 1. As indicated. If not indicated, assume the following and verify with Architect or Engineer prior to ordering.
  - 2. Hilti X-DNI37 P8 with steel washer.
    - a. Pin 0.145" shank dia. by 7/8" shank length.

## 2.08 SELF-DRILLING, SELF-TAPPING FASTENERS

- A. Buildex "TEK" brand fasteners or acceptable equivalent.
- B. Provide type, diameter and length indicated.
- C. If not indicated, assume the following for joining two thicknesses cold formed metal framing and verify with Architect/Engineer prior to ordering.
  - 1. #12 diameter hex head by 5/8" minimum length.

## PART 3 – EXECUTION

### 3.01 STORAGE OF MATERIALS

- A. Store materials and assemblies in a manner and location protected from damage, deformation and corrosion.
- B. Materials shall be stored on a flat plane.

### 3.02 INSTALLATION

- A. Connections: Self-drilling screws or welding shall meet or exceed the design loads, without distortion. All exterior connections shall be welded.
- B. Transversely loaded studs shall be installed seated squarely in tracks, and must be attached to them.
- C. Axially loaded studs shall be installed seated squarely (within 1/16") against the web portion of the top and bottom tracks. Tracks shall rest on a continuous uniform bearing surface. Cutting of steel framing members may be performed with saw or shear. Torch cutting of load bearing members is not permitted. Cutting of loaded members is not permitted unless under the supervision of the Project Engineer.
- D. Temporary bracing shall be provided and left in place until the work is permanently stabilized.
- E. Bridging - See Drawings.
- F. Diaphragm rated sheathing materials may be substituted for bridging, however, it shall be installed prior to loading the panel. If such a material is installed on one face only, then the other stud flanges shall be bridged with suitable bridging. This bridging may be removed if and when such diaphragm rated sheathing is installed.

- G. Install jamb assemblies at all openings. Jamb shall consist of members as indicated.
- H. Install headers in all openings in axially loaded panels that are larger than the stud spacing in that panel. Form headers as indicated.
- I. Insulation, as specified elsewhere and of thickness and value indicated for adjacent spaces, shall be installed in locations that will be inaccessible after their installation in the panel, or assembly.
- J. Provide jack studs to support each end of headers. These studs shall be securely connected to the header and jamb stud and must seat squarely in the lower track of the wall, and be properly attached to it.
- K. If by design, a header is low in the wall, the cripple studs over the header shall be designed to carry all imposed loads.
- L. Wall track shall not be used to support any load unless specifically designed for that purpose. Axially loaded members shall be aligned vertically, to allow for full transfer of the loads down to the foundation or other support member.
- M. Holes that are field cut into steel framing members shall be within the limitations of the member and its designed use, as referenced in the ICBO Report. Provide reinforcement where holes are cut through load bearing members in accordance with manufacturers' recommendations and as approved by the project engineer.
- N. Splicing of axially loaded members - not permitted.
- O. Provide additional members as required for joining panel to panel as well as for edge support for finish materials. Provide additional members where expansion joints are indicated, either in the panels or in the finish materials, as indicated.
- P. Wire ties - not permitted.
- Q. Where splices of track are necessary, between stud spacings, a piece of stud shall be placed in the track, fastened with two screws or welds to the flanges of each piece of track.
- R. Joists shall be installed as indicated with web stiffeners where indicated and in precise alignment with supporting members.

### 3.03 ERECTION

- A. Erect plumb and true. Install accessories as shown and as necessary for proper installation.
- B. Anchor top and bottom runner track to structure as shown.
  - 1. Studs shall sit squarely in the top and bottom runner track with firm abutment against track webs.
  - 2. Align and plumb studs and fasten to flanges of both top and bottom runner track. At corner and intersections of stud walls provide three studs minimum. Provide double studs at doors and other large openings. Double studs at head of door openings larger than 3 feet. Locate so as to provide surfaces for

attachment of facings on all sides. See structural drawings for exterior wall openings.

- C. Joining of members not indicated to be welded: Attach with self-drilling screws. Wire tying of framing members not permitted.
- D. Provide lateral bracing and bridging in accordance with manufacturer's recommendations and as shown.
- E. Splice or butt weld all butt joints in the runner track. No splices are permitted in tracks over lintels, or diagonal bracing.
  - 1. Weld connections by resistance spot or projection weld, fillet weld, or plug weld in accordance with AWS recommended procedures and practices.

**END OF SECTION**

**SECTION 05 50 00  
METAL FABRICATIONS**

**PART 1 – GENERAL**

1.1 SUMMARY

- A. Section includes shop fabricated metal items.

1.2 REFERENCES

- A. AA DAF-45 (Aluminum Association) - Designation System for Aluminum Finishes.
- B. AAMA 603.8 9 (American Architectural Manufacturers Association) - Performance Requirements and Test Procedures for Pigmented Organic Coatings on Extruded Aluminum.
- C. AAMA 605.2 (American Architectural Manufacturers Association) - Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
- D. AAMA 606.1 (American Architectural Manufacturers Association) - Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
- E. AAMA 607.1 (American Architectural Manufacturers Association) - Specifications and Inspection Methods for Clear Anodic Finishes for Architectural Aluminum.
- F. AAMA 608.1 (American Architectural Manufacturers Association) - Specification and Inspection Methods for Electrolytically Deposited Color Anodic Finishes for Architectural Aluminum.
- G. ANSI A14.3 - Ladders, Fixed, Safety Requirements.
- H. ASTM A36/A36M - Carbon Structural Steel.
- I. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe.
- J. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- K. ASTM A283/A283M - Low and Intermediate Tensile Strength Carbon Steel Plates.
- L. ASTM A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
- M. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- N. ASTM A325M - Standard Specification for High-Strength Bolts for Structural Steel Joints (Metric).
- O. ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- P. ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- Q. ASTM B26/B26M - Aluminum-Alloy Sand Castings.



- R. ASTM B85 - Aluminum-Alloy Die Castings.
- S. ASTM B177 - Chromium Electroplating on Steel for Engineering Use.
- T. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- U. ASTM B209M - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
- V. ASTM B210 - Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
- W. ASTM B210M - Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric).
- X. ASTM B2 - Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
- Y. ASTM B2M - Aluminum and Aluminum-Alloy Bar, Rod, and Wire (Metric).
- Z. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
- AA. ASTM B221M - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube (Metric).
- BB. AWS A2.4 (American Welding Society) - Symbols for Welding, Brazing, and Nondestructive Examination.
- CC. AWS D1.1: Current Edition, (American Welding Society) - Structural Welding Code.
- DD. SSPC (Steel Structures Painting Council) - Painting Manual.

### 1.3 SUBMITTALS FOR REVIEW

- A. Section 01 33 00 – Submittals: Shop Drawings, Product Data and Samples, Procedures for submittals.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
- C. Indicate welded connections using standard AWS A2.0 welding symbols. Indicate net weld lengths.

### 1.4 QUALIFICATIONS

- A. Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of California.
- B. Welders Certificates: Submit under provisions of Section 01400 – Quality Control, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

### 1.5 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with Chapter 22A, "Steel", of the California Code of Regulations, Title 24 - Building Standards, Part 2, 2019 California Building Code with State Amendments.
- B. Design, fabricate and erect miscellaneous metals in accordance with AISC'S Design, Fabrication and Erection of Structural Steel for Buildings.

- C. Conform to AWS D1.1 Code – Structural Welding Code.
- D. Inspection of Welding: See Section 01405: Testing and Inspection.
- E. Welding: See Section 01400: Quality Control.

## **PART 2 – PRODUCTS**

### **2.1 MATERIALS - STEEL**

- A. Structural Steel: All structural steel columns and beams W12 and larger shall conform to ASTM A992.
- B. Connection Plates & Base Plates: A572, grade 50.
  - 1. All Wide Flange Beams W10 and smaller, angles, channels & miscellaneous A36.
- D. Steel Sections: ASTM A36.
- E. Steel Tubing: ASTM A500, Grade B, or ASTM A501.
- F. Plates (To Include Backing Plates): ASTM A283.
- G. Pipe: ASTM A53, Grade B Schedule 40.
- H. Fasteners: Type, grade, and class required, zinc coated for exterior use.
- I. Bolts, Nuts, and Washers: ASTM A325 galvanized to ASTM A153 for galvanized components.
- J. Welding Materials: AWS D1.1; type required for materials being welded.
- K. Shop and Touch-Up Primer: Epoxy polyurethane in accordance with SSPC-PS 13.01 and with MIL-P-24441, Formula 150.

### **2.2 MATERIALS - ALUMINUM**

- A. Extruded Aluminum: ASTM B221.
- B. Sheet Aluminum: ASTM B209.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210.

### **2.3 COMPONENTS**

- A. The following is a list of principal items only. Refer to Drawings for items not specifically scheduled.
- B. Bumper Posts: As detailed; galvanized finish.
- C. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; galvanized finish.
- D. Door Frames for Overhead Door Openings and Wall Openings: Angle sections; prime paint finish.

## 2.4 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

## 2.5 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## 2.6 FINISHES - STEEL

- A. Prepare surfaces to be primed in accordance with SSPC SP.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime paint items with two coats.
- D. Non-structural Items: Galvanized after fabrication to ASTM A123. Provide minimum 1.25 oz/sq ft galvanized coating.

## 2.7 FINISHES - ALUMINUM

- A. Finish coatings to conform AAMA A41 anodized, prepared with a mechanical M12 - chemical C22 pre-treatment, anodized to clear color.
- B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## **PART 3 – EXECUTION**

### 3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

### 3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal and aluminum where site welding is required.
- B. Provide bolts, eyebolts, dowels, anchors, plates, inserts, and other miscellaneous items that are to be installed in forms before concrete pouring, or for building into masonry, as indicated. Examine and check the drawings for the number, type and location of such items.

### 3.3 DESCRIPTION OF ITEMS:

- A. Those items which are of standard or stock design or which are sufficiently detailed or described on the drawings to permit their fabrication and installation, are not covered herein even though they may be included in the Scope.
- B. Backing plates in connection with studs and furring necessary for engaging and fastening of stair rail brackets, lavatories and fixtures, etc., shall be provided in locations indicated, or as necessary. Securely fasten backing plates to studs supporting members in required position. Dap into wood studs. Weld between steel studs. Finish with rust inhibitive prime coat.
- C. Pipe handrails (if shown): Fabricate from 1 1/4" standard steel pipe to shapes and dimensions indicated. Make joints flush with concealed seamless fittings. Accurately cut, miter, weld and grind smooth to flush surfaces. Make bends to preserve the contour of the pipe. All railings shall meet all disabled access requirements. Install as follows:
  - 1. To masonry walls: Provide cast brackets providing 1 1/2" min. or indicated clearance between railing and wall. Secure to wall with screws into expansion shields.
  - 2. To stud walls: Provide cast brackets providing 1 1/2" min. or indicated clearance between railing and wall. Provide proper backing at studs at proper locations before application of gypsum board. Provide collar, flush metal filler, and secure to backing.
- D. Pipe guards: standard steel pipe as shown. Galvanized after fabricated.
- E. Wrought Iron Fence and Gates: Fabricate from wrought steel square tubes as shown and to match existing. Provide all necessary operating hardware for the gates. Reinstall salvaged fence and gates as required.
- F. Other miscellaneous metal work as indicated.

### 3.4 INSTALLATION

- 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. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

- C. 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.
- D. Field Welding: Comply with the following requirements:
  - 1. Field weld components indicated on shop drawings.
  - 2. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 3. Obtain fusion without undercut or overlap.
  - 4. Remove welding flux immediately.
  - 5. At exposed connections, finish exposed welds and surfaces smooth and blended.
- E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- F. Obtain approval prior to site cutting or making adjustments not scheduled.
- G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

### 3.5 ERECTION TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION**

**SECTION 05 55 00  
MISCELLANEOUS METALS**

**PART 1 – GENERAL**

- A. Requirements of Division 1 apply to this Section.

**1.1 WORK INCLUDED**

- A. Shapes, sleeves, anchors, connectors, plates, backing plates, supports, and fastenings required but which are not specified in other Sections.
- B. Pipe guards.
- C. Wrought Iron Fence and Gates.
- D. Other metal fabrications indicated.

**1.2 RELATED WORK SPECIFIED ELSEWHERE AS REQUIRED**

- A. Setting of items to be embedded in concrete.

**1.3 GENERAL REQUIREMENTS:**

- A. Field conditions: Verify drawing dimensions with actual field conditions. Inspect related work and adjacent surfaces. Report all conditions which prevent proper execution of this work.
- B. Shop Drawings: Submit in accordance with Section 0133 00 showing complete detail all information required for fabrication, finishing and installation of this work.
- C. Codes: Materials and work shall conform to the governing Building Code. In case of conflict between these specifications and the Building Code, the more stringent shall govern.
- D. General: Examine all drawings and specifications and include all miscellaneous metal that is not required to be furnished by another trade. Provide all connections, anchors, bolts, and other fastenings as required. Do all cutting, punching, drilling and tapping required for proper assembly of the work.
- E. Delivery: Insure that items to be set in concrete are delivered at the proper time.

**PART 2 – PRODUCTS**

**2.1 MATERIALS:**

- A. Steel shapes: Conform to ASTM A36.
- B. Structural pipe columns: Conform to ASTM A53, Grade B.
- C. Pipe for railings: Conform to ASTM A53 or A120.
- D. Cast iron: Conform to ASTM A48, soft gray iron.
- E. Malleable iron castings: Conform to ASTM A47.

- F. Welding rods: Conform to requirements of AWS for intended use.
- G. Galvanizing: Conform to ASTM A123.
- H. Bolts, nuts, screws: Conform to ASTM A307, Grade A.
- I. Steel plate: Conform to ASTM A283, Grade A.
- J. Steel tubing: Conform to ASTM A501 or A500.
- K. Bars, flats, rounds: Conform to ASTM A36, standard grade mild steel.
- L. Primer: Conforming to FS-TT-P-86, Type I.
- M. Touch-up for galvanized surfaces: All State #321 Galvanizing Powder (30% tin, 30% zinc, 40% lead and flux), "Galvalloy", "Galvover", or approved equal.
- N. Miscellaneous material: As indicated or specified.

## 2.2 SHOP PRIME COAT:

- A. Ferrous metal: Properly clean and prepare for painting in compliance with the paint manufacturer's instructions and apply one shop coat of material of the type specified. Thoroughly and completely cover all exposed surfaces as well as surfaces concealed after assembly. Apply paint by brush or spray gun, as best adapted to the paint material and surface conditions. Allow paint to become dry and hard before handling.
  - 1. Apply primer to 2 mil minimum dry coat thickness and touch up after installation and leave in proper condition to receive finish coats.

## 2.3 GALVANIZING:

- A. Galvanize all items to be exposed on the exterior and those interior items so specified. Use the hot dip process, conforming to ASTM A123.
- B. Average weight of zinc coating per square foot of actual surface: Not less than 2.0 ounces, with no individual specimen showing less than 1.8 ounces. (One oz. of zinc corresponds to a coating thickness of 0.0017".)

## 2.4 FABRICATION:

- A. Using skilled mechanics form and fabricate items of work as indicated and as required to meet installation conditions. Make provisions to connect with or receive the work of other trades.
- B. Unless otherwise indicated, weld or bolt connections between members. Where possible, conceal connections in the finished work. Where exposed screw fastenings are required, use Phillips ovalhead screws to match parent material. Fit or miter exposed joints to hairline tolerance or use welded joints. On finished surfaces, grind all welds smooth and flush with base metal.
- C. Bend pipe or tubing without collapsing or deforming the walls, and so as to provide a smooth uniform curved section and maintain uniform sectional shape.
- D. Where items are to be embedded in concrete, provide welded-on anchors or lugs as indicated or required.

## **PART 3 – EXECUTION**

### **3.1 ITEMS EMBEDDED IN CONCRETE OR MASONRY:**

- A. Provide bolts, eyebolts, dowels, anchors, plates, inserts, and other miscellaneous items that are to be installed in forms before concrete pouring, or for building into masonry, as indicated. Examine and check the drawings for the number, type and location of such items.

### **3.2 INSTALLATION:**

- A. Install all items plumb, level and square, securely and rigidly attached to supporting construction and as detailed.

### **3.3 DESCRIPTION OF ITEMS:**

- A. Those items which are of standard or stock design or which are sufficiently detailed or described on the drawings to permit their fabrication and installation, are not covered herein even though they may be included in the Scope.
- B. Backing plates in connection with studs and furring necessary for engaging and fastening of stair rail brackets, lavatories and fixtures, etc., shall be provided in locations indicated, or as necessary. Securely fasten backing plates to studs supporting members in required position. Dap into wood studs. Weld between steel studs. Finish with rust inhibitive prime coat.
- C. Pipe handrails (if shown): Fabricate from 1 1/4" standard steel pipe to shapes and dimensions indicated. Make joints flush with concealed seamless fittings. Accurately cut, miter, weld and grind smooth to flush surfaces. Make bends to preserve the contour of the pipe. All railings shall meet all disabled access requirements. Install as follows:
  - 1. To masonry walls: Provide cast brackets providing 1 1/2" min. or indicated clearance between railing and wall. Secure to wall with screws into expansion shields.
  - 2. To stud walls: Provide cast brackets providing 1 1/2" min. or indicated clearance between railing and wall. Provide proper backing at studs at proper locations before application of gypsum board. Provide collar, flush metal filler, and secure to backing.
- D. Pipe guards and bollards: standard steel pipe as shown. Galvanized after fabricated.
- E. Wrought Iron Fence and Gates: Fabricate from wrought steel square tubes as shown and to match existing. Provide all necessary operating hardware for the gates. Reinstall salvaged fence and gates as required. Fence and gates to be hot dip galvanized. Provide factory applied architectural coating over hot-dip galvanized steel "Colorgalv" by Duncan Galvanizing. Primer coat shall be factory applied prime coating. Apply primer within 12 hours after galvanizing at the same facility where the galvanizing is done. Finish coat shall be factory-applied high performance architectural finish. Apply finish coating at the galvanizer's plant, in a controlled environment as recommended by the finish coating manufacturer. Color to match existing steel fencing to remain at campus. Submit two 3 inch by 6 inch samples of factory applied coatings and colors proposed for use for approval prior to coating application. Provide 20 year warranty against rust.



F. Other miscellaneous metal work as indicated.

**END OF SECTION**

**SECTION 06 10 00  
ROUGH CARPENTRY**

**PART 1 – GENERAL**

1.01 SECTION INCLUDES

- A. Supply and install Rough Carpentry work as indicated.

1.02 RELATED SECTIONS

- A. Section 01 43 00: Quality Control.
- B. Section 01 45 29: Testing and Inspection.
- C. Section 03 30 00: Cast-In-Place Concrete.
- E. Section 09 29 00: Gypsum Board.

1.03 SUBMITTALS

- A. Submittals: Submit in accordance with Section 01 33 00 Submittal Procedures.

1.04 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**

2.01 MATERIALS

A. Lumber: Structural and framing lumber shall be of the following species and grades unless noted otherwise on the drawings:

	<u>USE</u>	<u>SPECIES</u>	<u>GRADE</u>
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. treated	Douglas Fir	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. Other plywood used for non-structural purposes shall be exterior type, or Exposure 1.

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. Plywood subflooring shall be "Underlayment", Group 1, Exposure 1; of thickness indicated.
- F. Mineral Fiber Panels: Shall be asbestos free, thickness as indicated.
- G. 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**

#### **3.01 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.

### 3.02 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. Beams, Girders and Joists:

1. Ends of wood beams, girders and joists which are 2'-0" or less above finished outside grade and which abut, but do not enter concrete or masonry walls, as well as wood blocking used in connection with ends of those members shall be treated with wood preservative.
2. Where wood beams, girders and joists enter masonry or concrete walls 2'-0" or less above outside wall, metal wall boxes or equivalent moisture barriers shall be provided between wood and masonry or concrete.

C. 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.

D. 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.

E. 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 20 00  
BUILDING INSULATION**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Furnish materials and perform labor required to execute this work as indicated on the drawings, as specified and as necessary to complete the Contract, including, but not limited to, these major items:
  - 1. Insulation below roof deck.
  - 2. Wall insulation.
  - 3. Sound batt insulation.

1.2 RELATED WORK SPECIFIED ELSEWHERE AS REQUIRED

- A. Acoustical treatment.
- B. Insulation of pipe and ducts.
- C. Partition framing.
- D. Roof framing.

1.3 GENERAL REQUIREMENT

- A. Batt insulation materials, including facing such as vapor barriers or breather papers, installed under this work shall have flame spread rating not to exceed 25 and smoke density not to exceed 450 when tested in accordance with UBC Standard 8-1 (ASTM E84), under installed conditions.
- B. Thermal Performance R shall be tested per ASTM C 518.

1.4 CERTIFICATION

- A. The Contractor shall certify that the insulation conforms to the requirements of the State Energy Code.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Wall and Roof Insulation: ASTM C665, Type III, FRK or FSK foil faced, with flame spread - 25, smoke developed - 50; perms -0.02 maximum. Manufacturer: CertainTeed Corp., Owens-Corning, Manville or approved equal. Unless otherwise shown on the drawings, thermal values shall be R-30 where used at roofs and R-19 where used at walls.
- B. Sound Insulation: Unfaced, friction fit conforming to ASTM C665 Type I. Flame spread 25. Manufacturer: CertainTeed Corp., Owens-Corning, Manville or approved equal.

- C. Staples: Conform to Fed. Spec. FF-N-105, "Nails, Wire and Staples", Amendment No. 2, except the staple dimensions shall be outside dimensions. Form from galvanized steel wire having a tensile strength range of 80,000 to 110,000 psi. Galvanize coating shall be Type I. Size: 16 gauge x 3/4" crown x 7/8" leg.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - ROOF**

- A. Install in conformance with the manufacturers' written instructions. There shall be a one inch air space at the roof sheathing and roofing framing shall be covered with the foil tensioning flange. Insulation shall completely fill the cavity. Thermal performance as shown on the drawings.

#### **3.2 INSTALLATION - WALLS**

- A. Install wall insulation between the wood or metal framing in conformance with the manufacturers' written instructions. Friction fit between the metal framing and stapled at wood framing. Insulation shall completely fill the cavity but not compressed. Thermal performance as shown on the drawings. Where concrete unit masonry walls are scheduled to be covered with gypsum drywall install in conformance with the manufacturers' written instructions.

**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 11 13  
HOLLOW METAL DOORS AND FRAMES AND WINDOW FRAMES**

**PART 1 - GENERAL**

1.01 WORK

- A. Custom fabricated hollow steel doors, door frames and glazed light frames with accessories and anchors complying with HMMA 861 "Guide Specifications for Commercial Hollow Metal Doors and Frames.

1.02 RELATED DOCUMENTS

- A. Drawings and general provisions of contract, including General and Supplementary conditions and Division 01 specification sections apply to this section.

1.03 RELATED WORK SECTIONS

- A. Section 08 71 00 Door Hardware
- C. Section 09 90 00 Painting

1.04 REFERENCES SPECIFIED

- A. ISO 9001 – Quality System.
- B. UL 10B - Fire Tests of Door Assemblies.
- C. UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies, UBC 7-2-1997 Fire Tests of Door Assemblies.
- D. UL10B or NFPA 252 at Atmospheric Pressure.
- E. A1008/A1008M – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Allow and High-Strength Low-Allow with Improved Formability.
- F. ASTM-A568 – General Requirements for Steel, Carbon and High Strength Low Alloy Hot Rolled Strip, and Cold Rolled Sheet.
- G. ASTM-A924 -General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
- H. ANSI A250.8/SDI-100 - Recommended Specifications for Standard Steel Doors and Frames.
- I. ANSI A250.11 - Recommended Erection Instructions for Steel Frames.
- J. SDI-107 - Hardware on Steel Doors (Reinforcement Application).
- K. NFPA-80 - Standard for Fire Doors and Windows.
- L. NFPA-101 - Life Safety Code.



- M. ANSI-A250.4 and ANSI-A250.5 -Test Procedure and Acceptance Criteria for Physical Endurance, Steel Doors and Frames.
- N. ANSI-A250.10 - Test Procedure and Acceptance Criteria for Painted Steel Surfaces for Steel Doors and Frames.
- O. ADA-The Americans with Disabilities Act - Title III - Public Accommodations.
- P. ANSI-A117.1 - American National Standards Institute - Accessible and Usable Buildings and Facilities.
- Q. U. L. - Underwriter's Laboratories.
- R. ITS - Intertek Testing Service [Warnock Hersey].
- S. CBC - California Building Code and Local Codes Including Authority Having Jurisdiction.
- T. N.F.P.A. 105 - Smoke and draft control assemblies.
- U. U.L. - 1784 Air leakage test of door assemblies.
- V. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen.
- W (HMMA) Hollow Metal Mfr's. Assoc., a Div. of National Assoc. of Arch. Metal Mfr's. (NAAMM), Guide Spec. for Commercial Hollow Metal Doors & Frames, HMMA Standard #861-87; NFPA #80

#### 1.05 SUBMITTALS

- A. Shop Drawings: Indicate door and frame elevations and sections, materials, gauges, fire ratings, finishes, fabrication and erection details, location and extent of hardware reinforcement, type and location of frame anchors, locations of finish hardware by dimension and locations/details of all openings and louvers. Do not proceed with any fabrication until all details are approved.
  1. Show all frame sections, anchorage of frames in openings, preparation for hardware, metal gauges, field splice joints, and other data.
  2. Doors: Show all construction; gauges, preparation for hardware, door lining materials, openings for louvers and glazing, and other data.
  3. Coordinate with Contractor and typically indicate acceptable tolerances to be incorporated into frame throat to allow for finish materials installation.
  4. Show elevations of each hollow metal door and window type, details of each frame type, location schedule using same reference numbers as contract drawings, details of installation in the various openings, wall thicknesses and materials to be encountered in this Project, installation requirements for hardware, and typical and special details of construction, including relationships to adjacent construction and materials.

- B. Certification of Compliance: Submit any information necessary to indicate compliance to these specifications. Finished work and shop drawings shall match approved samples.
- C. Submit samples prior to submission of shop drawings or beginning any fabrication.
  - 1. Samples will be retained until Project is completed.
  - 2. Door Construction: Provide cut-away sample showing edge, top, and bottom construction; insulation; hinge, closer, lock, and panic bar reinforcement; face stiffening.
  - 3. Frame Construction: Provide sample of typical profile, with welded corner joint, hinge and closer reinforcement, mortar guards, wall anchor, and floor anchor, in full compliance with these Project specifications. For exterior openings to receive glazing, provide additional sample of typical profile with glazing stops and ALL joints/seams filled and sealed watertight.
- D. Job Closeout: Provide two (two) complete manufacturer's catalogs to the building owner's designated representative.

#### 1.06 QUALITY ASSURANCE

- A. Source Quality Control: Products to be certified by manufacturer showing compliance with these specifications; specifically describe and certify complete hot-dipped galvanizing and shop prime painting of all hollow metal doors and frames at exterior openings. Certification must be submitted with shop drawings and with each product upon delivery. No doors or frames shall be delivered to job site, installed, or accepted without this certification.
- B. All hollow metal doors and frames shall be the product of one (1) manufacturer. Exceptions will not be permitted under any circumstances.
- C. Requirements of Regulatory Agencies: Conform to Title 24 CBC and NFPA #80 for fire-rated assemblies.
- D. Certification of label construction: For components exceeding Underwriters Laboratories, Inc. (UL)- furnish inspection certificate stating that component construction conforms to UL rating requirements only if architect is aware of such a limitation and has allowed the non-labeled unit.
- E. Certification of A-60 galvanizing and prime paint finishing.
- D. Certification that the Polystyrene Core Swinging Type Fire Doors – Model 707 as manufactured by The Curries Company, has been investigated by Underwriters Laboratories and certified for Standard(s) of Safety: UL 10C – Standard for Positive Pressure Fire Tests of Door Assemblies, UBC 7-2-1997, Fire Tests of Door Assemblies.
- E. Hollow metal manufacture shall be a SDI member.
- F. The Hollow Metal Manufacturer shall supply doors and frames through a national distribution system as described in 1.06.D herein. Marketing material through a factory direct method will not be acceptable to the building owner.
  - 1. Successful distributor shall be located within the project area.

- G. Hollow metal supplier shall be a qualified "local direct distributor" of products to be furnished. The distributor shall have in their regular employment an AHC and/or CDC with a local business address, telephone and fax line, which will be available at reasonable time's through-out the project, to consult with the architect, contractor and building owner regarding matters affecting the door and frame openings.
- H. Contractor will allow in his bid for the replacement of two exterior (2) doors selected at random by the project architect and owner's representative for dismantling and inspection of internal construction and compliance with the specification. Contractor to provide labor and tools for inspection under architect's direction.
- I. Failure of any hollow metal frame or door to meet specified standards shall be grounds to reject the entire shipment of hollow metal doors and frames, including the hollow metal manufacturer. Components shall be replaced at contractor's expense, including two additional doors for dismantling. No extensions of time or additions to the contract will be allowed due to a rejection of material and substitution of the hollow metal manufacturer.
- J, Installer requirement: Firm with a minimum of five years experience in the installation of metal doors and frames similar in the type included in this specification and have a meeting with lock representative for proper installation of said locks.
- K. A pre-construction meeting is required for proper installation of said lock.

#### 1.07 DELIVERY, STORAGE AND HANDLING

- A. Deliver doors and frames cardboard wrapped, crated, palletized or otherwise protected during transit and site storage.
- B. Inspect doors and frames upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and accepted by the architect. Otherwise remove and replace damaged items.
- C. Store doors and frames at the building site in a dry, secure place.
  - 1. Place units on minimum 4-inch high wood blocking.
  - 2. Avoid non-vented shelters [covering] that can create a humidity chamber.
  - 3. If cardboard wrapper on door becomes wet, remove carton immediately.
  - 4. Provide 1/4-inch spaces between stacked doors to promote air circulation.

#### 1.08 SEQUENCING AND SCHEDULING

- A. Sequencing, Scheduling: Verify all existing conditions, opening sizes, finishes, frame throat dimensions, existing conditions to remain, hardware, glazing, and doors with respective Sections.
- B. Deliver all doors and frames to the job site in a timely manner so as not to delay progress of other trades.
- C. Issue purchase orders to frame, door and hardware suppliers in sufficient time so as not to interfere with normal quoted delivery of materials.

## 1.09 WARRANTY

- A. Hollow metal doors and frames shall be supplied with a two (2) year warranty against defects in materials and workmanship.
- B. Warranty to commence with substantial completion of the job.

## PART 2 – PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS

- A. Or Equal, provided products meet the specified performance and construction requirements, and are acceptable to the building owner. Such products are subject to California Public Contracts Code Section 3400.
- B. Performance criteria as specified in 2.03 will be supported by an independent laboratory cycle and twist test certification document, and will be included in the supplier's shop submittals. The building owner's authorized representative including locksmith and project supervisor will review any proposed substitution. Request will be required ten (10) days before bid. Request will require a complete sample of product with supporting data. In addition, the architect and owner will be furnished a list of a minimum of twenty (20) local (75-mile radius of client) institutional end-user customers with facilities locksmith names and telephone numbers.
- C. Manufacturers:
  - A. Curries, Division of AADG, Inc.
  - B. Krieger
  - C. Stiles

### 2.02 MATERIALS

- A. Steel requirements, all doors and frames to be manufactured of commercial quality, stretcher leveled flatness, cold rolled steel per ASTM-A1008 and A-568 general requirements or galv. to A60 minimum coating weight standard per ASTM-A924 or A653 hot dip galvanized to A60 minimum coating weight standard. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A1011.
  - 1. Typical, For Frames at Interior Openings: ASTM A-366; Prime quality, cold rolled, pickled and annealed, free from scale pitting and surface defects.
  - 2. Typical, For Exterior Doors and Frames at Exterior Openings: ASTM A525 and ASTM A526; Prime quality, cold rolled, zinc coated (fully galvanized) by the hot dip process,
  - 3. Coating Materials Primer: all doors and frames to be bonderized and finished as standard with manufacturer's baked-on primer conforming to ANSI-A250.10, or galvanized conforming to Commercial Quality A-60 or G-90 (1.25 oz/sq. ft.), free from scale pitting and surface defects. Use stretcher leveled sheets for doors and panels.
- C. Door Core
  - 1. Polystyrene core. All doors to have:
    - a. Fiberglass: Semi-rigid compressed fiberglass board, 6 pcf density, R = 4.55/inch.

- b. Fire-Rated Doors: As required to provide required ratings.
  - c. Permanently bonded to the inside of each face sheet providing rigidity, insulating and sound deadening properties to the door.
  - d. Refer to 2.03 for additional specification.
  - e. Steel ribbed core doors are unacceptable and will be rejected and
  - f. replaced at the contractor's expense.
2. Temperature rise rated doors should be provided for stairwell enclosures, which indicate "Temperature rise 30 minutes - 450 degrees F maximum or 250 degrees F maximum" as required by the local building code.
- D. Glass lite frames in doors fabricated of not less than 18 GA. galvanized steel with attachment screws allowed only on the non-secure side, screws not visible when viewing door lite frame face.
- 1. Metal Moldings/Frames and Stops For Glass Lites In Hollow Metal Doors: Provided by door mfr., fixed moldings integral with interior side of door; glass channels fully continuously welded watertight; loose stops min. 18 ga. for exterior side of door, tightly butted corner joints. At fire-rated doors, provide fire-rated stops.
    - a. Glazing Stops For Glass Lites & Porcelain Enamel Panels in Frames:
      - i. Typical: #20 ga., 5/8" deep typical; unless noted otherwise.
      - ii. All Exterior Stops: Galvanized A-60 or G-90.
      - iii. Stops For Fire-Rated Glass: #16 ga. min., 3/4" deep typical (5/8" min.); verify with glass mfr. for the particular fire rating.
- E. Security Metal Louvers For Hollow Metal Doors: "Anemostat" Type PLSL, fixed inverted split-Y, #18 ga. steel louvers, #12 ga. frame, #12 ga. security grille face plates with 13/16" sq. perforations, security thru-bolt fasteners, baked prime coat finish, with integral insect screen at exterior locations.
- F. Fastenings: As required; FHSM vandalproof / tamper-resistant screws for glazing stops. Use stainless steel type screws at exterior doors.
- G. Electric Through Wire [HMD]
- 1. Provide all hollow metal doors receiving electrified hardware with electrical through-door wiring harness and concealed plug connectors on each end to accommodate up to twelve wires.
  - 2. Coordinate connectors on each end of the wiring harness to plug directly into the electrified hardware and the electric hinge.
- F. Electric Through Wire [HMF]
- 1. Provide all hollow metal frames receiving electrified hardware with Electrical wiring harness and concealed plug connectors to accommodate up to twelve wires.
  - 2. Coordinate connectors on end of the wiring harness to plug directly into the

electrified hardware and the electric hinge.

## 2.03 FABRICATION

### A. General

1. Fabricate all doors and frames in accordance with ANSI A250.8-1998/SDI-100 except where requirements that are more stringent are specified.
2. As detailed on plans, fabricated "welded" frame units to be delivered to job site as single units. Transoms, sidelights, and window walls, which are "oversize" for transportation and installation, shall be furnished with field splices to be field assembled by the general contractor.
3. Supply only doors and frames manufactured by the acceptable manufacturer listed in this specification.
4. Doors to be 707 Series as manufactured by the Curries Co, Mason City, IA. 727 Series at Temperature rise rated doors, which indicate "Temperature rise 30 min.- 450F degrees maximum or 250F degrees maximum" as required by local building code.
5. Prepare doors to receive door hardware per approved schedule, including internal reinforcing. Do not include unnecessary cutouts in door faces not required by hardware template.

### B. Door Construction

1. Classification: SDI Level 3 - Model 2 (16GA.) at all interior and exterior drs.
2. Face sheets formed of cold rolled steel.
3. Exterior doors to be galvanized to A60 minimum weight standard.
4. Seamless construction [Equal to Curries 707T] by continuous wire weld of both edges full height of door, and to be performed at the factory.
5. Lite and louver door cutouts: Furnish perimeter channel reinforcement and seal watertight by supplier.
6. Lock edges beveled 1/8 inch in 2 inches.
7. Door lock edge reinforcing shall be one-piece, full height 14GA. Channel. Door hinge edge reinforcing shall be one-piece, full height 12GA. Channel formed and tapped for hinges or as required per listed hardware.
8. Both hinge and lock channels to be welded to each face sheet of the door.
9. Top and bottom channels:
  - a. Not less than 16GA. - flush or inverted.
  - b. Welded to the face sheet.
  - c. Close tops of exterior doors flush by the addition of 16GA. Galvanized steel channel fillers. Channel filler to sealed watertight.

10. Astragals: To be flat security type or 'Z' as called for in the specifications.
11. All doors to conform to A.N.S.I.-A 250.4 Test Procedure and Acceptance Criteria for Physical Endurance. Door size cycle tested to be 4070 to min. Level A performance. Furthermore, doors will have been subjected to an additional one (1) million cycle and twist tests with a combined two (2) million cycles and 46 twist tests. Testing to be accomplished by an independent lab. Certification of these criteria to be submitted with approval drawing by the HM distributor.
12. Transom Panels: To be constructed similar to doors.
13. Where indicated, provide insert type louvers in bottom of doors. Louvers to be not less than 18 GA. prime coated steel.
14. Minimum HG/FG stiles shall be six (6) inches wide. Top rail shall be a minimum eight (8) inches.

C. Door and Window Frame Construction

1. Frames shall comply with ANSI/SDI A250.5 Level A, one-million cycle swing test performance for a 4070 door frame.
2. All frames to be formed from cold rolled steel. Furnish 14GA. door and window frames at exterior openings and 16GA. at interior. Exterior door and window frames to be galvanized to A60 minimum weight standard.
3. All frames are to be Full Profile welded, ground smooth, and re-primed at the welded area.
4. Window frame glass stops shall be minimum 18GA. steel and 5/8" in height.
  - a. Exterior stops and countersunk flat-head attachment screws to be galvanized.
  - b. Typical, unless noted or detailed otherwise: Integral stop at interior face; loose (removable) stops at exterior face, for field assembly with countersunk removable vandalproof screws at 16" o.c. typical.
  - c. Removable Stops: #20 ga., 5/8" x 5/8" typical, unless noted otherwise. Finish to match steel frames, A-60 hot-dipped galvanize at all exterior openings.
  - d. All exposed screws to be non-magnetic stainless steel; finish to match steel frames.
5. Provide temporary shipping bars to help protect from damage during transit and handling.
  - a. Temporary shipping bars to be removed before setting frames.
6. All welds on frames, transoms and sidelites to be flush with neatly mitered or butted material cuts.

D. Frame Anchors: Provide sufficient anchorage to attach to wall in accordance with ANSI/SDI A250.5-'94 Test Compliance Level A of one million cycles, or anchorage as detailed on plans to specific wall conditions.

1. Wall anchor for frame attachment to masonry construction: Masonry anchors, adjustable, flat, corrugated or perforated 'T' shaped anchors with leg not less than 2 inches wide by 10 inches long or masonry "wire" type not less than 3/16" diameter.

2. All frame jamb anchors to be provided: one each jamb per 24 inches of frame height or fraction thereof (minimum 3 in masonry or concrete and 4 in stud construction). Furnish a minimum of two head anchors for frames installed in stud walls and three or more anchors in frame width exceeding 42".
3. Floor anchors - angle clip type:
  - a. Minimum 14 GA.
  - b. To receive two (2) fasteners per jamb.
  - c. Welded to the bottom of each jamb.
4. In place masonry or concrete:
  - a. 3/8 inch countersunk flat head stove bolt and expansion shields.
  - b. Spaced 6 inches from top and bottom of frame and at 26 inches on center maximum between.
  - c. Weld pipe spacers or other type of spacers per manufacturer's standard design in back of frame soffit to protect frame profile during tightening of bolts and anchors.
5. Head struts: for frames not anchored to masonry or concrete construction provide ceiling struts spot-welded to jambs each side extending to building structure where called for on schedule.

E. Hardware Preparation [NOTE: Utility door prep is not acceptable]

1. Reinforcements: reinforce components for hardware installation in accord with ANSI-A115. Provide minimum gage hardware channel type reinforcing for mortise or surface applied hardware as follows:

Hinge - 7 GA. on frames for mortise butt hinges (min 1-1/4"x10").

Cont Hinge - 12 GA. full length on frames for continuous hinges.

Lock - 12 GA. or equivalent number of threads.

Panic Devices - 14 GA.

Surface Closer - 12 GA.

Hold Open Arm - 12 GA.

Other Items - Conform to HMMA Standards

Field drilling and/or tapping for surface applied hardware is installation contractor's responsibility.

2. Punch single leaf frames to receive three (3) silencers. Double leaf frames to receive two silencers per leaf at head.
3. Factory prepared hardware locations to be in accord with "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames", as adopted by The Steel Door Institute.



4. Grout solid all frames in masonry or concrete walls. Provide steel plaster-guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings. Protect inside throat of each frame in grout filled wall conditions or where antifreeze additives are used in fill, with a waterproof undercoating material minimum 1/8" thick, field applied by installer.
- F. Drips:
1. Location: Provide at all locations where indicated and at all new or replacement exterior door frames where there is no above-the-door overhang which projects beyond a line drawn upward at 45 degrees from the door head.
  2. Construction: 14 ga; Steel material same as door frame; tack weld to top of door frame embedded in wall; seal watertight; see Details.
- G. Water Penetration: Borrowed lite assemblies, transom, sidelite, and combination transom sidelite frames are not factory sealed to prevent water penetration. In situations where water penetration is a concern, contractor must seal with a high quality long lasting sealant, all joints that are exposed to the elements after the frame assembly is installed. Whenever possible, it is recommended that glass and glazing be installed on the exterior rabbet of the frame assembly. This will help act as a deterrent to water penetration.
- The member companies of the hollow metal industry cannot control the workmanship associated with the frame installation; therefore, it is the responsibility of the installer to assure all steps are taken to prevent water penetration.
- H. Excess Material
1. Contractor to deliver any unused doors and frames to the building owner's designated representative.

## **PART 3 – EXECUTION**

### **3.01 FRAME INSTALLATION**

- A. Erection Installation: Install hollow metal units in accordance with manufacturer's instructions and final shop drawings. Fit doors to frames and floors with proper clearances and to achieve the maximum operational effectiveness and appearance of each unit. SDI 122-99 "Installation and Trouble Shooting Guide for Standard Steel Doors and Frames" or "The Installation of Commercial Steel Doors and Steel Frames" as published by DHI are recommended guidelines.
- B. Set welded frames in position prior to beginning partition work. Brace frames until permanent anchors are set.
- C. Set anchors for frames as work progresses. Install anchors at hinge and strike levels.
- D. Use temporary setting spreaders at all locations. Use intermediate spreaders to assure proper door clearances and header braces for grouted frames.
- E. Install frames in prepared openings in concrete and masonry walls using countersunk bolts and expansion anchors.
- F. Install all fire rated frames in accord with requirements of N.F.P.A.-80.
- G. Where frames require ceiling struts or other structural overhead bracing, they shall be anchored securely to structure above, as required.

- H. Frames shall be filled solid with Portland cement grout where shown or required by class of opening in masonry or concrete walls. Provide steel plaster guards or mortar boxes, welded to frame, at back of hardware cutouts where installed in concrete, masonry or plaster openings. Protect inside throat of each frame in grout filled wall conditions or where antifreeze additives are used in fill, with a waterproof undercoating type material minimum 1-2 mils thick and field applied by installer.

### 3.02 DOOR INSTALLATION

- A. Install hollow metal doors in frames using hardware specified in Section 08710 Finish Hardware. Doors are to be expertly hung and shall fit snug against all stops. Doors shall fit accurately and hang free from hinge bind with a uniform clearance of 1/8 inch at head and jambs. After hanging, make all adjustments and then remove respective hardware for finish painting. Reinstall hardware after finish painting.
- B. Maximum clearances at edge of doors:
  - 1. Between door and frame at head and jambs: 1/8 inch.
  - 2. At meeting edges pairs of doors and at mullions: 1/8 inch.
  - 3. At transom panels, without transom bars: 1/8 inch.
  - 4. At sills without thresholds: 5/8 inch max above finish floor.
  - 5. At sills with thresholds: 1/8 inch above threshold.
- C. Hardware Installation: to be installed securely without marking or defacing hardware or finish work. Protect finish hardware with suitable protective covering until completion of building. Hardware to be in perfect working order. Clean and polish.

### 3.03 ADJUSTMENT AND CLEANING

- A. Remove dirt and excess sealant, mortar or glazing compounds from exposed surfaces.
- B. Adjust for smooth operation as required. Install shims as required to allow for proper closing.
- C. Fill all dents, holes, etc. with metal filler and sand smooth and flush with adjacent surfaces - reprime/paint to match finish.

### 3.04 FINISH; FRAMES & DOORS

- A. Cleaning: After assembly, clean thoroughly, removing all rust, scale, grease, oil, rough spots. Use Hand Tool Cleaning (SSPC-SP2) or Power Tool Cleaning (SSPC-SP3) as applicable.
- B. Touch-Up Coating of Galvanized Work: After assembly, prior to prime painting, clean and coat all abraded or damaged galvanizing coating with cold galvanizing compound, 3 mils minimum thickness, per mfr's. requirements to achieve a finish equal to min. A-60 hot-dipped galvanizing.
- C. Prime Painting: After surfaces are clean, phosphatize and prime with one coat of specified rust inhibitive primer, baked on, 1.5 mils dry film thickness minimum.
- D. At All Frames To Be Solid Grouted: Coat inside of frame profile with bituminous coating to a thickness of 1/16 inch.

### 3.05 ADJUSTMENT

- A. Straighten, repair, and/or replace damaged work.

- B. Repair any damaged or abraded areas of prime coat.
- C. Repair any sealant leaks watertight.

**END OF SECTION**

**SECTION 08 71 00  
DOOR HARDWARE**

**PART 1 – GENERAL**

1.01. SUMMARY

- A. Section Includes:
  - 1. Door hardware.
- B. Related Divisions:
  - 1. Division 08 – metal doors and frames,

1.02. REFERENCES:

- A. Use date of standard in effect as of Bid date.
  - 1. American National Standards Institute
    - a. ANSI 156.18 – Materials and Finishes.
  - 2. BHMA – Builders Hardware Manufacturers Association
  - 3. 2019 California Building Code
    - a. Chapter 11B – Accessibility To Public Buildings, Public Accommodations, Commercial Buildings and Public Housing
  - 4. DHI – Door and Hardware Institute
  - 5. NFPA – National Fire Protection Association
    - a. NFPA 80 2016 Edition – Standard for Fire Doors and Other Opening Protectives.
    - b. NFPA 105 – Smoke and Draft Control Door Assemblies
    - c. NFPA 252 – Fire Tests of Door Assemblies
  - 6. UL – Underwriters Laboratories
    - a. UL10C – Positive Pressure Fire Tests of Door Assemblies.
    - b. UL 305 – Panic Hardware
  - 7. WHI – Warnock Hersey Incorporated State of California Building Code
  - 8. Local applicable codes
  - 9. SDI – Steel Door Institute
  - 10. WI – Woodwork Institute
  - 11. AWI – Architectural Woodwork Institute
  - 12. NAAMM – National Association of Architectural Metal Manufacturers
- B. Abbreviations
  - 1. Manufacturers: see table at 2.1.A of this section
  - 2. Finishes: see 2.7 of this section.

1.03. SUBMITTALS & SUBSTITUTIONS

- A. SUBMITTALS: Submit six copies of schedule per D. Only submittals printed one sided will be accepted and reviewed. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening. Minimum 10pt font size. Include following information:
  - 1. Type, style, function, size, quantity and finish of hardware items.
  - 2. Use BHMA Finish codes per ANSI A156.18.
  - 3. Name, part number and manufacturer of each item.
  - 4. Fastenings and other pertinent information.
  - 5. Location of hardware set coordinated with floor plans and door schedule.
  - 6. Explanation of abbreviations, symbols, and codes contained in schedule.

7. Mounting locations for hardware.
  8. Door and frame sizes, materials and degrees of swing.
  9. List of manufacturers used and their nearest representative with address and phone number.
  10. Catalog cuts.
  11. Point-to-point wiring diagrams.
  12. Manufacturer's technical data and installation instructions for electronic hardware.
  13. Date of jobsite visit.
- B. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.
  - C. Deviations: Highlight, encircle or otherwise identify deviations from "Schedule of Finish Hardware" on submittal with notations clearly designating those portions as deviating from this section.
  - D. If discrepancy between drawings and scheduled material in this section, bid the more expensive of the two choices, note the discrepancy in the submittal and request direction from Architect for resolution.
  - E. Substitutions per Division 1. Include product data and indicate benefit to the Project. Furnish operating samples on request.
  - F. Items listed with no substitute manufacturers have been requested by Owner to meet existing standard.
  - G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturers' installation, adjustment and maintenance information, and supplier's final inspection report.

1.04. QUALITY ASSURANCE:

- A. Qualifications:
  1. Hardware supplier: direct factory contract supplier who employs a certified architectural hardware consultant (AHC), available at reasonable times during course of work for project hardware consultation to Owner, Architect and Contractor.
    - a. Responsible for detailing, scheduling and ordering of finish hardware. Detailing implies that the submitted schedule of hardware is correct and complete for the intended function and performance of the openings.
- B. Hardware: Free of defects, blemishes and excessive play. Obtain each kind of hardware (latch and locksets, exit devices, hinges and closers) from one manufacturer.
- C. Exit Doors: Operable from inside with single motion without the use of a key or special knowledge or effort.
- D. Fire-Rated Openings: NFPA 80 compliant. Hardware UL10C (positive pressure) compliant for given type/size opening and degree of label. Provide proper latching hardware, non-flaming door closers, approved-bearing hinges, and resilient seals. Coordinate with wood door section for required intumescent seals. Furnish openings complete.
- E. Furnish hardware items required to complete the work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.
- F. Pre-Installation Meetings: Initiate and conduct with supplier, installer and related trades, coordinate materials and techniques, and sequence complex hardware items and systems installation. Include manufacturers' representatives of locks, panic hardware and door closers in the meetings. Convene prior to commencement of related work

1.05. DELIVERY, STORAGE AND HANDLING:

- A. Delivery: coordinate delivery to appropriate locations (shop or field).
  - 1. Permanent keys and cores: secured delivery direct to Owner's representative.
- B. Acceptance at Site: Items individually packaged in manufacturers' original containers, complete with proper fasteners and related pieces. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.
- C. Storage: Provide securely locked storage area for hardware, protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold, etc.

1.06. PROJECT CONDITIONS AND COORDINATION:

- A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical the same operation and quality as type specified, subject to Architect's approval.
- B. Coordination: Coordinate hardware with other work. Furnish hardware items of proper design for use on doors and frames of the thickness, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information on the Contract Documents. Furnish related trades with the following information:
  - 1. Location of embedded and attached items to concrete.
  - 2. Location of wall-mounted hardware, including wall stops.
  - 3. Location of finish floor materials and floor-mounted hardware.
  - 4. At masonry construction, coordinate with the anchoring and hollow metal supplier prior to frame installation by placing a strip of insulation, wood, or foam, on the back of the hollow metal frame behind the rabbet section for continuous hinges, as well as at rim panic hardware strike locations, silencers, coordinators, and door closer arm locations. When the frame is grouted in place, the backing will allow drilling and tapping without dulling or breaking the installer's bits.
  - 5. Locations for conduit and raceways as needed for electrical, electronic and electro-pneumatic hardware items. Fire/life-safety system interfacing. Point-to-point wiring diagrams plus riser diagrams to related trades.
  - 6. Coordinate: back-up power for doors with automatic operators.
  - 7. Coordinate: flush top rails of doors at outswinging exteriors, and throughout where adhesive-mounted seals occur.
  - 8. Manufacturers' templates to door and frame fabricators.
- C. Check Shop Drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
- D. Environmental considerations: segregate unused recyclable paper and paper product packaging, uninstalled metals, and plastics, and have these sent to a recycling center.
- E. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material. If conflict between the specified/scheduled hardware and existing conditions, submit request for direction from Architect. Include date of jobsite visit in the submittal.
  - 1. Submittals prepared without thorough jobsite visit by qualified hardware expert will be rejected as non-compliant.

1.07. WARRANTY:

- A. Part of respective manufacturers' regular terms of sale. Provide manufacturers' written warranties.

B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:

C. Minimum warranties:

- |                   |                         |
|-------------------|-------------------------|
| 1. Locksets:      | Three years             |
| 2. Exit Devices:  | Three years mechanical  |
| 3. Closers:       | Thirty years mechanical |
| 4. Hinges:        | One year                |
| 5. Other Hardware | Two years               |

#### 1.08. COMMISSIONING:

A. Conduct these tests prior to request for certificate of substantial completion:

1. With installer present, test door hardware operation with climate control system and stairwell pressurization system both at rest and while in full operation.
2. With installer, access control contractor and electrical contractor present, test electrical, electronic and electro-pneumatic hardware systems for satisfactory operation.
3. With installer and electrical contractor present, test hardware interfaced with fire/life-safety system for proper operation and release.

#### 1.09. REGULATORY REQUIREMENTS:

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 California Building Code, Section 11B-404.2.7.

1. Panic hardware: locate between 36 inches to 44 inches above the finished floor.

B. Handles, pull, latches, locks, other operable parts:

1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of the wrist to operate. 2019 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2019 California Building Code Section 11B-309.4.

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.

D. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2019 California Building Code Section 11B-404.2.8.

1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2019 California Building Code Section 11B-404.2.10.

1. Applied kickplates and armor plates: bevel the left and right edges; free of sharp or abrasive edges.
2. Tempered glass doors without stiles: bottom rail may be less than 10 inches if top leading edge is tapered 60 degrees minimum.

- F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2019 California Building Code Section 11B-404.2.3.
  - 1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
  - 2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2019 California Building Code 11B-307.4.
- G. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway, per 2019 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2019 California Building Code Section 11B-303.2 & ~.3.
- H. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).
- I. Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2019 California Building Code Section 11B-703.4.2.
- J. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door may not encroach/project more than 7 inches into the required exit width, with the exception of door release hardware such as lockset levers or panic hardware. These hardware items must be located no less than 34-inches and no more than 48-inches above the floor/ground. 2019 California Building Code, Section 1005.7.1.
  - 1. In I-2 occupancies, surface mounted latch release hardware, mounted to the side of the door facing away from the adjacent wall where the door is in the open position, is not exempt from the inclusion in the 7-inch maximum encroachment, regardless of its mounting height, per 2019 California Building Code, Section 1005.7.1 at Exception 1.



## PART 2 – PRODUCTS

### 2.01 MANUFACTURERS:

- A. Listed acceptable alternate manufacturers: these will be considered; submit for review products with equivalent function and features of scheduled products.

ITEM:	MANUFACTURER:	ACCEPTABLE ALTERNATE:
Hinges	(IVE) Ives	Bommer
Key System	(SCH) Schlage	District standard
Mechanical Locks	(SCH) Schlage	District standard
Electronic Locks	(SCE) Schlage Electronics	District standard
Exit Devices	(VON) Von Duprin	District standard
Closers	(LCN) LCN	District standard
Auto Flush Bolts	(IVE) Ives	DCI
Coordinators	(IVE) Ives	DCI
Silencers	(IVE) Ives	Rockwood, Trimco
Push & Pull Plates	(IVE) Ives	Rockwood, Trimco
Kickplates	(IVE) Ives	Rockwood, Trimco
Stops & Holders	(IVE) Ives	Rockwood, Trimco
Overhead Stops	(GLY) Glynn-Johnson	ABH
Thresholds	(ZER) Zero	NGP, Pemko
Seals & Bottoms	(ZER) Zero	NGP, Pemko

### 2.02 HINGING METHODS:

- A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable. Use wide-throw conventional or continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening. Advise architect if 8-inch width is insufficient.
- B. Conform to manufacturer's published hinge selection standard for door dimensions, weight and frequency, and to hinge selection as scheduled. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices, notify Architect of deviation from scheduled hardware.
- C. Conventional Hinges: Steel or stainless-steel pins and approved bearings. Hinge open widths minimum, but of sufficient throw to permit maximum door swing.
1. Outswinging exterior doors: non-ferrous with non-removable (NRP) pins.
  2. Non-ferrous material exteriors and at doors subject to corrosive atmospheric conditions.

## 2.03 LOCKSETS, LATCHSETS, DEADBOLTS:

### D. Mortise Locksets and Latchsets: as scheduled.

1. Lever Trim: through-bolted, accessible design, cast lever or solid extruded bar type levers as scheduled. Filled hollow tube design unacceptable.
  - a. Spindles: security design independent breakaway. Breakage of outside lever does not allow access to inside lever's hubworks to gain wrongful entry.
2. Furnish solid cylinder collars with wave springs. Wall of collar to cover rim of mortise cylinder.
3. Turnpieces: accessible offset turn-lever design not requiring pinching or twisting motions to operate.
4. Deadbolts: stainless steel 1-inch throw.
5. Strikes: 16 gage curved steel, bronze or brass with 1-inch deep box construction, lips of sufficient length to clear trim and protect clothing.
6. Certifications:
  - a. ANSI A156.13, 1994, Grade 1 Operational, Grade 1 Security.
  - b. ANSI/ASTM F476-84 Grade 31 UL Listed.
7. Accessibility: Require not more than 5 lb to retract the latchbolt or deadbolt, or both, per CBC 2019 11B-404.2.7 and 11B-309.4.

## 2.04 EXIT DEVICES / PANIC HARDWARE

### A. General features:

1. Independent lab-tested 1,000,000 cycles.
2. Push-through push-pad design. No exposed push-pad fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
3. Deadlocking latchbolts, 0.75 inch projection.
4. End caps: impact-resistant, flush-mounted. No raised edges or lips to catch carts or other equipment.
5. No exposed screws to show through glass doors.
6. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.
7. Releasable in normal operation with 15-pound maximum operating force per UBC Standard 10-4, and with 32-pound maximum pressure under 250-pound load to the door.
8. Exterior doors scheduled with XP-series devices: Static load force resistance of at least 2000 pounds.
9. Accessibility: Require not more than 5 lb to retract the latchbolt, per CBC 2019 11B-404.2.7 and 11B-309.4.
  - a. Mechanical method: Von Duprin "AX-" feature, where touchpad directly retracts the latchbolt with 5 lb or less of force. Provide testing lab certification confirming that the mechanical device is independent third-party tested to meet this 5 lb requirement.
  - b. Electrical method: Von Duprin's "RX-QEL-", where lightly pressing the touchpad with 5 lb or less of force closes an electric switch, activating quiet electric latch retraction.

### B. Specific features:

1. Lever Trim: breakaway type, forged brass or bronze escutcheon min. 0.130 inch thickness, compression spring drive, match lockset lever design.
2. Fire-Labeled Devices: UL label indicating "Fire Exit Hardware". Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.

3. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key. Furnish storage brackets for securely stowing the mullion away from the door when removed.
4. Accepted substitutions: None, District standard.

## 2.05 CLOSERS

- A. Surface Closers: [4041]
1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome-silicon steel spring.
  2. ISO 2000 certified. Units stamped with date-of-manufacture code.
  3. Independent lab-tested 10,000,000 cycles.
  4. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
  5. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
  6. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2019 California Building Code Section 11B-404.2.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.
    - a. Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.
  7. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
  8. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
  9. Exterior door closers: tested to 100 hours of ASTM B117 salt spray test, furnish data on request.
  10. Exterior doors: seasonal adjustments not required for temperatures from 120 degrees F to -30 degrees F, furnish checking fluid data on request.
  11. Non-flaming fluid will not fuel door or floor covering fires.

## 2.06 OTHER HARDWARE

- A. Automatic Flush Bolts: Low operating force design.
- B. Overhead Stops: Non-plastic mechanisms and finished metal end caps. Field-changeable hold-open, friction and stop-only functions.
- C. Kick Plates: Four beveled edges, .050 inches minimum thickness, height and width as scheduled. Sheet-metal screws of bronze or stainless steel to match other hardware.
- D. Door Stops: Provide stops to protect walls, casework or other hardware.
  1. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners. Where floor type cannot be used, provide wall type. If neither can be used, provide overhead type.
  2. Locate overhead stops for maximum possible opening. Consult with Owner for furniture locations. Minimum: 90deg stop / 95deg deadstop. Note degree of opening in submittal.
- E. Thresholds: As scheduled and per details. Comply with CBC 2019 11B-404.2.5. Substitute products: certify that the products equal or exceed specified material's thickness. Proposed substitutions: submit for approval.
  1. Saddle thresholds: 0.125 inches minimum thickness.

2. Exteriors: Seal perimeter to exclude water and vermin. Use sealant complying with requirements in Division 7 "Thermal and Moisture Protection". Minimum 0.25 inch diameter fasteners and lead expansion shield anchors, or Red-Head #SFS-1420 (or approved equivalent) Flat Head Sleeve Anchors. National Guard Products' "COMBO" or Pemko Manufacturing's "FHSL".
  3. Fire-rated openings, 90-minutes or less duration: use thresholds to interrupt floor covering material under the door where that material has a critical radiant flux value less than 0.22 watts per square centimeter, per NFPA 253. Use threshold unit as scheduled. If none scheduled, include a 0.25in high 5in wide saddle in the bid, and request direction from Architect.
  4. Fire-rated openings, 3-hour duration: Thresholds, where scheduled, to extend full jamb depth.
  5. Acoustic openings: Set units in full bed of Division-7-compliant, leave no air space between threshold and substrate.
  6. Plastic plugs with wood or sheet metal screws are not an acceptable substitute for specified fastening methods.
  7. Fasteners: Generally, exposed screws to be Phillips or Robertson drive. Pinned TORX drive at high security areas. Flat head sleeve anchors (FHSL) may be slotted drive. Sheet metal and wood screws: full-thread. Sleeve nuts: full length to prevent door compression.
- F. Through-bolts: Do not use. Coordinate with wood doors; ensure provision of proper blocking to support wood screws for mounting panic hardware and door closers. Coordinate with metal doors and frames; ensure provision of proper reinforcement to support machine screws for mounting panic hardware and door closers.
1. Exception: surface-mounted overhead stops, holders, and friction stays.
- G. Silencers: Interior hollow metal frames, 3 for single doors, 4 for pairs of doors. Leave no unfilled/uncovered pre-punched silencer holes. Intent: door bears against silencers, seals make minimal contact with minimal compression – only enough to effect a seal.

## 2.07 FINISH:

- A. Generally: BHMA 626 Satin Chromium.
1. Areas using BHMA 626: furnish push-plates, pulls and protection plates of BHMA 630, Satin Stainless Steel, unless otherwise scheduled.
- B. Door closers: factory powder coated to match other hardware, unless otherwise noted.

## 2.08 KEYING REQUIREMENTS:

- A. Key System: Schlage Everest [D] utility-patented keyway, interchangeable core. Utility patent protection to extend at least until 2014. Key blanks available only from factory-direct sources, not available from after-market key blank manufacturers. For estimate use factory GMK charge. Initiate and conduct meeting(s) with Owner and Allegion representatives to determine system keyway(s), keybow styles, structure and degree of geographic exclusivity. Furnish Owner's written approval of the system; do not order keys or cylinders without written confirmation of actual requirements from the Owner. Contractor will install permanent cylinders/cores.
- B. Keys
1. Existing factory registered master key system.
  2. Construction keying: furnish temporary keyed-alike cores. Remove at substantial completion and install permanent cylinders/cores in Owner's presence. Demonstrate that construction key no longer operates.
  3. Furnish 10 construction keys.
  4. Furnish 2 construction control keys.
  5. Furnish 2 Emergency keys per each L9485 Faculty Restroom Lock
- C. Key Cylinders: furnish utility patented, 6-pin solid brass construction.

- D. Cylinder cores: furnish keyed at factory of lock manufacturer where permanent records are maintained. Locks and cylinders same manufacturer.
- E. Permanent keys: use secured shipment direct from point of origination to Owner.
  1. For estimate: 3 keys per change combination, 5 master keys per group, 5 grand-master keys, 3 control keys.
  2. For estimate: VKC stamping plus "DO NOT DUPLICATE".
  3. Bitting List: use secured shipment direct from point of origination to Owner upon completion.

**PART 3 - EXECUTION**

3.01 ACCEPTABLE INSTALLERS:

- A. Can read and understand manufacturers' templates, suppliers' hardware schedule and printed installation instructions. Can readily distinguish drywall screws from manufacturers' furnished fasteners. Available to meet with manufacturers' representatives and related trades to discuss installation of hardware.

3.02 PREPARATION:

- A. Ensure that walls and frames are square and plumb before hardware installation. Make corrections before commencing hardware installation. Installation denotes acceptance of wall/frame condition.
- B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
  1. Notify Architect of code conflicts before ordering material.
  2. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2019 California Building Code, Section 1010.1.9.2 and 11B-404.2.7.
  3. Locate panic hardware between 36 inches to 44 inches above the finished floor.
  4. Where new hardware is to be installed near existing doors/hardware scheduled to remain, match locations of existing hardware.
- C. Overhead stops: before installing, determine proposed locations of furniture items, fixtures, and other items to be protected by the overhead stop's action.
- D. Existing frames and doors to be retrofitted with new hardware:
  1. Field-verify conditions and dimensions prior to ordering hardware. Fill existing hardware cut outs not being reused by the new hardware. Remove existing hardware not being reused, return to Owner unless directed otherwise.
  2. Remove existing floor closers not scheduled for reuse, fill cavities with non-shrinking concrete and finish smooth.
  3. Cut and weld existing steel frames currently prepared with 2.25 inch height strikes. Cut an approximate 8 inch section from the strike jamb and weld in a reinforced section to accommodate specified hardware's strike.
  4. Patch and weld flush filler pieces into existing door hardware preparations in steel doors and frames, leave surfaces smooth.
  5. Glue in solid wood block fillers to fill cut outs in existing wood doors, sand surfaces smooth. Alternatively, use an approved epoxy-based wood filler product, submit product data for approval.

3.03 INSTALLATION

- A. Install hardware per manufacturer's instructions and recommendations. Do not install surface-mounted items until finishes have been completed on substrate. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate for proper installation and operation. Remove and reinstall or replace work deemed defective by Architect.

1. Gaskets: install jamb-applied gaskets before closers, overhead stops, rim strikes, etc; fasten hardware over and through these seals. Install sweeps across bottoms of doors before astragals, cope sweeps around bottom pivots, trim astragals to tops of sweeps.
  2. When hardware is to be attached to existing metal surface and insufficient reinforcement exists, use RivNuts, NutSerts or similar anchoring device for screws.
  3. Use manufacturers' fasteners furnished with hardware items, or submit Request for Substitution with Architect.
  4. Replace fasteners damaged by power-driven tools.
- B. Locate floor stops no more than 4 inches from walls and not within paths of travel. See paragraph 2.2 regarding hinge widths, door should be well clear of point of wall reveal. Point of door contact no closer to the hinge edge than half the door width. Where situation is questionable or difficult, contact Architect for direction.
- C. Core concrete for exterior door stop anchors. Set anchors in approved non-shrink grout.
- D. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.
- E. Drill pilot holes for fasteners in wood doors and/or frames.
- F. Lubricate and adjust existing hardware scheduled to remain. Carefully remove and give to Owner items not scheduled for reuse.
- G. Field-verify existing conditions and measurements prior to ordering hardware. Fill existing hardware cut outs not being used by the new hardware.
- H. Remove existing hardware not being reused. Tag and bag removed hardware, turn over to Owner.
- I. Where existing wall conditions will not allow door to swing using the scheduled hinges, provide wide-throw hinges and if needed, extended arms on closers.
- J. Provide manufacturer's recommended brackets to accommodate the mounting of closers on doors with flush transoms.

### 3.04. ADJUSTING

- A. Adjust and check for proper operation and function. Replace units, which cannot be adjusted to operate freely and smoothly.
1. Hardware damaged by improper installation or adjustment methods: repair or replace to Owner's satisfaction.
  2. Adjust doors to fully latch with no more than 1 pound of pressure.
    - a. Door closer valves: turn valves clockwise until at bottom – do not force. Turn valves back out one and one-half turns and begin adjustment process from that point. Do not force valves beyond three full turns counterclockwise.
  3. Adjust delayed-action closers on fire-rated doors to fully close from fully-opened position in no more than 10 seconds.
  4. Adjust door closers per 1.9 this section.
- B. Inspection of fire door assemblies and means-of-egress panic-hardware doors: Per 2016 NFPA-80 5.2.1: hire an independent third-party inspection service to prepare a report listing these doors, and include a statement that there are zero deficiencies with the fire-rated assemblies and the openings with panic hardware.
- C. Fire-rated doors:
1. Wood doors: adjust to 0.125 inches clearance at heads, jambs, and meeting stiles.

2. Steel doors: adjust to 0.063 inches minimum to 0.188 inches maximum clearance at heads, jambs, and meeting stiles.
  3. Adjust wood and steel doors to 0.75 inches maximum clearance (undercut) above threshold or finish floor material under door.
- D. Final inspection: Installer to provide letter to Owner that upon completion installer has visited the Project and has accomplished the following:
1. Has re-adjusted hardware.
  2. Has evaluated maintenance procedures and recommend changes or additions, and instructed Owner's personnel.
  3. Has identified items that have deteriorated or failed.
  4. Has submitted written report identifying problems.

3.05 DEMONSTRATION:

- A. Demonstrate mechanical hardware and electrical, electronic and pneumatic hardware systems, including adjustment and maintenance procedures.

3.06 PROTECTION/CLEANING:

- A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, etc. Remove covering materials and clean hardware just prior to substantial completion.
- B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.07 SCHEDULE OF FINISH HARDWARE

- A. See door schedule in drawings for hardware set assignments.
- B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

HEADING 01			
1	SGL	Door 100	EXTERIOR / SERVICE BAY
1	SGL	Door 101	EXTERIOR / OFFICE
1	SGL	Door 109	EXTERIOR / PARTS STORAGE
36.000 X 96.000 X 1.750 X HMD X HMF X --			

Each Assembly to have:

Qty	EA	Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	ENTRANCE W/DEADBOLT	L9453T 06A L583-363 L283-711	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	LOCK GUARD	LG12	630	IVE
1	EA	SURFACE CLOSER	4041 DEL EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142AA (OMIT @ OVERHANG)	AA	ZER
1	SET	SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	545A-223 (OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

MOUNT HEAD SEAL BEFORE CLOSER ARM.

HEADING 02

1 SGL Door 102 SERVICE BAY / OFFICE  
 1 SGL Door 103 SERVICE BAY / LOUNGE

36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	626	IVE
1	EA OFFICE/ENTRY LOCK	L9050T 06A L583-363 L283-711	626	SCH
1	EA FSIC CORE	23-030 EV D	626	SCH
1	EA SURFACE CLOSER	4041 DEL	689	LCN
1	EA FLOOR STOP	FS436/438 AS REQ'D	626	IVE
1	SET SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA DOOR SWEEP	111AA	AA	ZER
1	EA THRESHOLD	545A-223 (OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

HEADING 03

1 SGL Door 105 ALCOVE / STAFF RESTROOM

36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	626	IVE
1	EA PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1	EA SURFACE CLOSER	4041 DEL	689	LCN
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA MOP PLATE	8400 4" X 1" LDW B-CS	630	IVE
1	EA WALL STOP	WS406/407CCV AS REQ'D	630	IVE
1	SET SET SEAL	429AA-S (@ HEAD & JAMBS)	AA	ZER
1	EA THRESHOLD	545A-223 (OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER

HEADING 04

1 SGL Door 107 SERVICE BAY / CHEMICAL STORAGE

36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	626	IVE
1	EA STOREROOM LOCK	L9080T 06A	626	SCH
1	EA FSIC CORE	23-030 EV D	626	SCH
1	EA SURFACE CLOSER	4041 DEL EDA	689	LCN
1	EA FLOOR STOP	FS436/438 AS REQ'D	626	IVE
3	EA SILENCER	SR64	GRY	IVE

HEADING 05

1 SGL Door 104 LOUNGE / STAFF RESTROOM

36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty	Description	Catalog Number	Finish	Mfr
3	EA HINGE	5BB1 4.5 X 4.5	626	IVE
1	EA PRIVACY LOCK	L9040 06A L583-363 L283-722	626	SCH
1	EA SURFACE CLOSER	4041 DEL EDA	689	LCN
1	EA KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA FLOOR STOP	FS436/438 AS REQ'D	626	IVE
1	EA GASKETING	488SBK PSA	BK	ZER
1	EA THRESHOLD	545A-223 (OR AS REQ'D. OR PER DETAIL/CONDITIONS)	A	ZER



HEADING 06

1 SGL Door 106 ALCOVE / TOOLS STORAGE  
36.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	626	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4041 DEL	689	LCN
3	EA	SILENCER	SR64	GRY	IVE

HEADING 07

1 PR Door 108 SERVICE BAY / PARTS STORAGE  
72.000 X 84.000 X 1.750 X HMD X HMF X --

Each Assembly to have:

Qty		Description	Catalog Number	Finish	Mfr
6	EA	HINGE	5BB1 4.5 X 4.5	626	IVE
1	SET	CONST LATCHING BOLT	FB51P	630	IVE
1	EA	DUST PROOF STRIKE	DP1/2 AS REQ'D.	626	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4041 DEL SCUSH	689	LCN
1	EA	ASTRAGAL	44STST	STST	ZER
2	EA	SILENCER	SR64	GRY	IVE

HEADING 08

1 RU Door 113 CANOPY / SERVICE BAY  
1 RU Door 114 EXTERIOR / SERVICE BAY  
252.000 X 144.000 X 1.750 X STL X STL X --  
1 RU Door 112 CANOPY / SERVICE BAY  
1 RU Door 115 EXTERIOR / SERVICE BAY  
264.000 X 144.000 X 1.750 X STL X STL X --  
1 RU Door 110 CANOPY / PARTS STORAGE  
1 RU Door 111 CANOPY / PARTS STORAGE  
120.000 X 120.000 X 1.750 X STL X STL X --

HARDWARE TO BE PROVIDED BY DOOR MANUFACTURER.

END OF SECTION

**SECTION 09 29 00  
GYPSUM BOARD**

**PART 1 - GENERAL**

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
- b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

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

## **PART 2 - PRODUCTS**

### **2.1 INTERIOR GYPSUM BOARD**

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Gypsum Co.
    - b. National Gypsum Company.
    - c. PABCO Gypsum.
    - d. USG Corporation.
- B. Regular Type:
  1. Thickness: 1/2 inch (12.7 mm).
  2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Type X:
  1. Thickness: 5/8 inch (15.9 mm).
  2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- D. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
  1. Thickness: 1/2 inch (12.7 mm).
  2. Long Edges: Tapered.
- E. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.
  1. Core: 5/8 inch, Type X, USG VHI Abuse-Resistant or approved equal.
  2. Long Edges: Tapered.
- F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.

## 2.2 TILE BACKING PANELS

### A. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M or ASTM C 1396/C 1396M.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Gypsum Co.
  - b. National Gypsum Company.
  - c. USG Corporation.
3. Core: As indicated on Drawings.

### B. Cementitious Backer Units: ANSI A108.1.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Custom Building Products; Wonderboard.
  - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
  - c. USG Corporation; DUROCK Cement Board.
3. Thickness: 1/2 inch (12.7 mm).

## 2.3 TRIM ACCESSORIES

### A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. Bullnose bead.
  - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - d. L-Bead: L-shaped; exposed long flange receives joint compound.
  - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

- f. Expansion (control) joint.
  - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. Pittcon Industries.
  - 3. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
  - 4. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

## 2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
- 1. Interior Gypsum Wallboard: Paper.
  - 2. Exterior Gypsum Soffit Board: Paper.
  - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  - 4. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
- 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Exterior Applications:

1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:

1. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
3. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Division 7 Section "Joint Sealants."
1. Provide sealants that have a VOC content of 250 < g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Thermal Insulation: As specified in Division 7 Section "Building Insulation."
- G. Vapor Retarder: As specified in Division 7 Section "Building Insulation."

## 2.6 TEXTURE FINISHES

- A. Primer: As recommended by textured finish manufacturer.

- B. Polystyrene Aggregate Ceiling Finish: Water-based, job-mixed, polystyrene aggregate finish with flame-spread and smoke-developed indexes of not more than 25 when tested according to ASTM E 84.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. G-P Gypsum; Georgia-Pacific Regency Ceiling Textures/Polystyrene.
    - b. National Gypsum Company; Perfect Spray.
    - c. USG Corporation; SHEETROCK Ceiling Spray Texture, QT.
  3. Texture: Fine.
- C. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture finish for spray application.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. G-P Gypsum; Georgia-Pacific Ceiling Textures/Vermiculite.
    - b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
  3. Texture: Light spatter.

### **PART 3 - EXECUTION**

#### **3.1 APPLYING AND FINISHING PANELS, GENERAL**

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

### 3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Regular Type: Vertical surfaces, unless otherwise indicated].
  - 2. Type X: As indicated on Drawings or Where required for fire-resistance-rated assembly.
  - 3. Ceiling Type: Ceiling surfaces.
  - 4. Abuse-Resistant Type: Gymnasium walls typical.
  - 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.

### 3.3 APPLYING TILE BACKING PANELS

- A. Water-Resistant Gypsum Backing Board: Install at showers, tubs, and where indicated. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.1, at [showers, tubs, and where indicated] [locations indicated to receive tile].
- C. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
- D. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners, unless otherwise indicated.
  - 2. Bullnose Bead: Use at outside corners.
  - 3. LC-Bead: Use at exposed panel edges.
  - 4. L-Bead: Use where indicated.
  - 5. U-Bead: Use at exposed panel edges.
  - 6. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.



- 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Not Used.
  - 4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.
  - 5. Level 5: Not Used.
    - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.6 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

### 3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

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 08 11 13 – Hollow Metal Doors and Frames and Window Frames.
- C. 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. Dunn-Edwards has been adopted by the PUSD Board of Education as the “sole source” paint for use in the District.
- 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 in 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 & Galvanized Metal Deck; 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 EVERSIELD (EVSH50), 100% Acrylic Gloss Enamel EVERSIELD (EVSH60)
  - d. Coat 3: EVERSIELD 100% Acrylic Semi-Gloss Enamel-(EVSH50) EVERSIELD, 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 EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - e. Coat 4: 100% Acrylic Enamel Sash EVERSIELD,100% Acrylic Semi-Gloss Enamel (EVSH500)  
Or EVERSIELD, 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 1/4" 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-EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - d. DFT: 4 mils.
5. Factory Finished Equipment & Items:
- a. Coat 1: Acrylic Enamel Sash & Trim EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - e. Coat 3: 100% Acrylic Enamel EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH60)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
    - c. Coat 3: 100% Acrylic Exterior Wood EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Ext. Masonry Finish (EVSH10)
    - c. Coat 3: Exterior Masonry Finish SPARTASHIELD, Exterior 100% Acrylic Flat Finish (SSHL10)  
or EVERSIELD, 100% Acrylic Ext. Masonry Finish (EVSH10)
    - 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
  - c. Coat 3: Exterior Masonry Finish EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50) or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - d. DFT: 3.6 mils.
  
5. Concrete Block:
  - a. Coat 1: Masonry Filler BLOCFIL SMOOTH BLOCFIL PREMIUM, Concrete Block Filler, Smooth (SBPR00)
  - b. Coat 2: Concrete Sealer
  - c. Coat 3: Exterior Masonry Finish SPARTASHIELD, Exterior 100% Acrylic Flat Finish (SSHL10)
  - d. Coat 4: Exterior Masonry Finish SPARTASHIELD, Exterior 100% Acrylic Flat Finish (SSHL10)
  - e. DFT for coats 2-4: 3.6mil.
  
6. Painted Stripes At Exterior Concrete Stairs; Conform to State HDCP Requirements:
  - a. Stripes: 2" wide, Located 1" max from and parallel to nosing.
  - b. Required Locations: All treads and upper approach of each flight of stairs.
  - c. Application Rate: 2 coats of Traffic Paint, at 400 sf/per gallon per coat. VIN-L-STRIPE, (W 801)
  
7. 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)
  - c. Application Rate/DFT for finish coats: As required to cover completely one coat to cover.
  
8. Painted Stripes At Exterior Concrete Stairs; Conform to State HDCP Requirements:
  - a. Required Locations: Bottom tread and upper approach of each flight of stairs, where indicated.
  - b. Stripes: 2" wide, located 1" max form parallel to nosing.
  - c. Applications Rate: 2 coats of Traffic Paint, at 400 sf/ per gallon per coat. VIN-L-STRIPE, (W 801)

C. INTERIOR PAINT SCHEDULE

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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH60)
  - c. Coat 3: 100% Acrylic Semi-Gloss Enamel EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
  - c. Coat 3: Enamel, Semi-Gloss EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
  - c. Coat 3: Enamel, Semi-Gloss EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
Or EVERSIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
    - 2) Enamel, Low Sheen EVERSIELD, 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. EVERSIELD, (W901) or EVERSIELD, (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 EVERSIELD, 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 EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
Or EVERSIELD, 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 EVERSIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
- c. Coat 3: Stipple Enamel, Semi-Gloss EVERSIELD, Int. 100% Acrylic Semi-Gloss Enamel (EVSH50)
- d. DFT: 5 mils.

D. Metal Work; Interior:

1. Galvanized Metal & Galvanized Metal Deck;

- 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 EVERSIELD 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
- d. Coat 3: 100% Acrylic Enamel Enamel EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
Or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
- e. DFT: 6 mils.

2. Ungalvanized Steel Interior 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 EVERSIELD 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - c. Coat 3: 100% Acrylic Enamel Enamel EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
Or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - e. 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 1/4" 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; 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - d. DFT: 4 mils.
  
6. Factory Finished Equipment & Items:
  - a. Coat 1:Acrylic Enamel Sash & Trim EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 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 EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - e. Coat 3: 100% Acrylic Enamel EVERSIELD, 100% Acrylic Semi-Gloss Enamel (EVSH50)  
or EVERSIELD, 100% Acrylic Gloss Enamel (EVSH60)
  - f. DFT: 5 mils.

**END OF SECTION**



**SECTION 10 14 00  
IDENTIFYING DEVICES**

**PART 1 – GENERAL**

1.01 REFERENCE

- A. Requirements in Addenda, Alternates, Conditions, and Division 01 collectively apply to this work.
- B. Code-mandated accessibility signage and room occupancy signage complying with CBC requirements and District standards.
- C. Project, building, name/number, school address, building directories complying with CBC requirements and District standards

1.02 DESCRIPTION

A. Principal Work Items Are:

- 1. Plastic Plaques & Signs:
  - a. Combination Room number/name plaques.
  - b. Accessibility Signage
  - c. Directional Signage

2. Main Entry Sign

B. Related Work Specified Elsewhere:

- 1. Supporting Construction: Respective Sections.

C. Related Work By District: Provide exact numbering and wording for plaques.

D. Description Of System:

- 1. Text, letters, symbols, and Braille must be raised and integral to signage surface; GLUING ABOVE ITEMS ON IS NOT ACCEPTABLE.
- 2. Signage is a two-component system consisting of a metal mounting base frame and removable/replaceable signage face.

1.03 SUBSTITUTIONS

- A. This specified signage system has been adopted by the Pasadena Unified School District. No Substitutions will be accepted for this specified system.

1.04 QUALITY ASSURANCE

A. Requirements Of Regulatory Agencies; Codes:

- 1. California Building Code (CBC) and Standards.
- 2. Conform to Federal Americans With Disabilities Act (ADA), Section 3105(A)e and to Title-24, Division of the State Architect / Access Compliance Section "Accessibility" (Handicapped) Regulations.

## 1.05 SUBMITTALS

### A. Samples; 2 Copies:

1. Submittals: Submit color and texture samples of all materials to be used for signs.
2. Sample sign; typical room name - number plaque.
3. Samples: Submit 1 full size sample of toilet room signs.
4. All submittals shall be made in accordance with Section 01 33 00.
5. Shop Drawings: Submit shop drawings showing sizes of signs and lettering, construction details of signs and anchoring details.

### B. Product Data; 4 Copies: Mfr.'s standard brochures describing all items and materials; specific items for this work shall be indicated/highlighted.

### C. Shop Drawings:

1. Signs; 4 Copies: All work.
2. Room Name-Number list coordinated to District numbering standards and approved by District.

## 1.06 JOB CONDITIONS

### A. Coordination: Verify exact numbering and wording for all work with District, prior to fabrication.

### B. Sequencing, Scheduling: Verify type of supporting construction; provide suitable concealed attachment fasteners.

### C. Existing Wall Surfaces: Verify wall finish is tight to substrate and will not affect the signage attachment.

## PART 2 – PRODUCTS

### 2.01 SIGNAGE; GENERAL

#### A. Type: for use throughout the Project.

1. General: Typical signage to be 2 component metal-plastic base frame with plastic sign insert type; 8" x 8" square.
2. Plastic Sign: 2 piece with radius corners – Sign Front Acrylic "Mitsubishi Shinkolite", non-glare, clear, high grade cast acrylic 0.125 inch thickness adhered to 0.125 inch thickness "Sinatra" White PVC Sign Back with 3M adhesive strips creating (2) void slots for window inserts; suitable for interior and/or exterior use. Acrylic Face shall be back-painted with District selected color.
3. Metal-Plastic Base: "JRS" Model #640; 1/2" deep x 1/8" thick Black Anodized aluminum base frame with 9/16" radius corners with black plastic base inside and outside of back of frame.
4. Tactile Text/Letters/Symbols/Braille:
  - a. All to be raised per ADA requirements.

- b. All letters and numbers shall be a District selected color, which contrasts with the District selected background color.
  - c. Tactile letters and numbers shall be 3/4" in height, raised Rowmark ADA reverse engravable Ultra-Matte, 1/16" thick, inlayed, computer routed with beveled edge per ADA. Clear Acrylic faceplate shall be routed to receive the text (Incised Method). The text shall be permanently bonded to the acrylic sign face with IPS weld-on solvent acrylic cement. Plaque shall be run through cold laminator to achieve perfect adherence of text to plaque surface. Adherence of text to face shall be such that it is physically impossible for the text to be removed by vandals. Finished routed-in text shall be raised a minimum of 1/32" above surface of the faceplate.
  - d. Provide text corresponding Grade 2 Braille under all text per ADA. Braille shall be Raster with clear acrylic raised beads. The Braille beads shall be permanently chemically fused and bonded to the acrylic sign face. Adherence of beads to face shall be such that it is physically impossible for the beads to be removed by vandals.
5. Window Plaque for Identification Signs:
- a. Screen print solid area of plaque onto second surface of clear acrylic face piece with District selected color.
  - b. Leave (2) one-inch height clear insert spaces across plaque width for windows.
6. Plaques Without Windows:
- a. Screen print graphics and/or text to second surface (back side) of face piece. Paint solid color, as selected by District, on second surface (back side) of face piece. Adhere to back piece, using 3M adhesive.
- B. Type Imagery:
- 1. Type Style: "Helvetica Medium", all UPPER case; 3/4" high (72 point).
  - 2. Arrangement: Use "standard" spacing between letters, words, numbers, and lines; centered typically; 1/2" minimum margins.
- C. Layout: Braille dots shall be typically located 1/2" minimum from frame or mounting screws. Braille shall be located below and flush right, 3/8" minimum, from tactile characters.
- D. Edges: Finish all edges smooth. Provide a mounting hole at each corner for vandal-resistant screws.
- E. Mounting: Mount plaque inside metal frame. Utilize stainless steel vandal-resistant screws with plastic expansion anchors and clear silicon sealant to secure signage to wall surfaces. Use 3M VHB double-sided tape to mount frame to glazing surface when having to mount sign on a window surface.
- F. Acceptable Manufacturers/Products:
- 1. H. Toji & Company, 15320 South Broadway, Gardena, CA 90248; Phone (310) 323-5210, Fax (310) 329-7621.
  - 2. This Product is a Pasadena U.S.D. Standard. Other Mfrs. shall match precisely the specified fabrication per these Specifications.

G. Signage shall conform to CBC Chapter 11 and requirements of ADA:

1. Character type: Characters on signs shall be raised 1/32 inch (0.794 mm) minimum and shall be sans serif uppercase characters accompanied by Grade 2 Braille (see 5 below).
2. Character size: Raised characters on signs shall be a minimum of 5/8 inch (15.9 mm) and a maximum of 2 inches (51 mm) high.
3. Finish and contrast: Contrast between character, symbols and their background must be 70% minimum and have an anti-glare finish. 11B-703.5.1, 11B-703.6.2, 11B-703.7.1.
4. Proportions: Characters on signs shall have a width-to height ratio of between 3:5 and 1:1 and a stroke width-to height ratio of between 1:5 and 1:10. Per CBC Section 11B-703.2.4, 11B-703.2.6, 11B-703.5.4, 11B-703.5.5.

All letters measured must be uppercase. After choosing a typestyle to test, begin by printing the letters I, X, and O at 1 inch high. Place the template's 1:1 square over the X or O, whichever is narrower. If the character is not wider than 1 inch, nor narrower than the 3:5 rectangle, the proportions are correct. Use the 1:5 rectangle to determine if the stroke of the I is too broad, and the 1:10 rectangle to see if it is too narrow. If all the tests are passed, the typestyle is compliant with proportion code.

5. Braille: California Grade 2 Braille shall be used wherever Braille is required. Dots shall be 1/10 inch (2.54 mm) on centers in each cell with 2/10 inch (5.08 mm) space between cells, measured from the second column of dots in the first cell to the first column of dots in the second cell. Dots shall be raised a minimum of 1/40 inch (0.635 mm) above the background. Per CBC Section 11B-703.3. Use rounded or domed California Braille Dots.

2.02 ROOM NAME / NUMBER PLAQUES

A. General: Conform to Article 2.01.

B. Wording:

- a. Wording will vary from plaque, but plaques will average 12 letters and four numbers per plaque. Wording shall be in English.
- b. A four-digit room number shall be placed on each room. The first digit for the School shall identify the building as 1, 2, 3 etc. The second number shall indicate the floor number 1, 2, 3 or 4, and the last two numbers shall indicate the room number between 1 and 99 on the particular floor of the building. Buildings shall be numbered starting from the Administration Building as 1 in a counter-clockwise direction. Classrooms and other rooms commonly used by students shall be numbered with even numbers on one side of the hallway and odd numbers on the opposite side of the hallway. These smaller numbers shall be used on the most frequently used rooms. Upon numbering these frequently used rooms, use the balance of the numbers to identify the rest of the rooms.
- c. Arrange words in a single line of text where possible within the limitations imposed for number of characters per line. Use additional lines where necessary to accommodate longer texts. Do not hyphenate words.
- d. A line shall be provided to place a teacher's name on the sign that can be easily changed.

## 2.03 FIRE ALARM SIGNS

- A. General: Conform to Article 2.01.
- B. Wording: FIRE  
ALARM  
INSIDE
- C. Construct per Plaque Without Windows listed above. Verify with District "Red" letters on "White" background.
- D. Size: 8" x 8"

## 2.04 PLASTIC HDCP ACCESSIBILITY SYMBOL SIGNS

- A. General: Conform to Article 2.01, Plaques Without Windows, (except as indicated) and to Handicapped Accessibility Codes.
- B. Symbol Signs:
  - 1. Figure/Symbol Style: Recognized standard "International Symbols of Accessibility" such as those developed by the American Institute of Graphics for the U.S. Dept. of Transportation.
  - 2. Types:
    - a. Toilet Room Door Signs: Appropriate Man/Boy or Woman/Girl silhouette figures, superimposed over geometric symbols.
      - (1) Color: White figure on blue geometric symbol.
      - (2) Geometric Symbols:
        - (a) For Men/Boys: An equilateral triangle, 12" on a side; 1/4" thick.
        - (b) For Women/Girls: A 12" diameter circle; 1/4" thick.
        - (c) For Both Sexes: An equilateral triangle, 12" on a side, superimposed over a 12" diameter circle; 1/4" thick.
    - b. Building Entrance Signs:
      - (1) Size: 8" x 8", typically.
      - (2) International symbol of accessibility.
      - (3) Color to be "White" symbols on Internationally accepted "Blue" background.
    - c. Wheelchair Lift Sign:
      - (1) Size: 8" x 8", typically.

## 2.05 FIRE EXTINGUISHER SIGNS

- A. General: Conform to Article 2.01.

Wording: FIRE EXTINGUISHER INSIDE

- C. Construct per Plaque Without Windows listed above. Verify with District "Red" letters on "White" background.
- D. Size: 8" x 8"

2.06 DIRECTIONAL SIGNAGE

Provide directional signs, from the Administration area, at all corners and stairs that provide classroom number direction. Signs shall be heavy duty, edge relived, black phenolic raised letter signs with white letters and an arrow and permanently attached to the walls with adhesive and screws. The sign shall be 3 inches by 6 inches and the information shall be in-scripted in three lines. Where additional lined are required, the sign shall be appropriately sized.

2.07 ACCESSORIES

Label Making Software and Weather Resistant Vinyl Coated Compatible Label Paper: Sign Manufacturer shall furnish and install on the school's computer at the school site, where signs are installed, the software and/or hardware for publishing labels for the above specified signs. If possible, the software shall be compatible with the site's computer and printer hardware. Additionally furnish a box (minimum count of 100 full-size sheets) of weather resistant vinyl coated label paper for use in printing label inserts for the specified signs. Provide training as requested by site staff to illustrate how to set-up and print labels and install them on the signs.

The sign subcontractor shall provide to the school staff as part of this package of equipment, a complete set of room numbers and a complete set of teacher names for each sign as directed by the Architect.

2.08 LOW LEVEL PATHWAY INDICATORS:

A. Low Level Pathway Model 11.00 PSL manufactured and represented by Active Safety, 5 E 4800S, Suite 100, Salt Lake City, Utah 84107 (800) 657-6324.

- |     |                    |   |
|-----|--------------------|---|
| 1.  | Path Marking Size: | 1-3/4" - 4" width<br>51" length<br>1/8" depth   |
| 2.  | Color:             | Standard - green illuminating   |
| 3.  | Attachment:        | Aluminum J-mold track, custom colors available  |
| 4.  | Activation:        | 3-5 foot candles ambient lighting   |
| 5.  | Directional:       | Optional arrows for one way existing only   |
| 6.  | Lift Expectancy:   | Twenty five years+  |
| 7.  | Construction:      | PSL 11.000: Self-illuminating polystyrene laminate Aluminum J-mold  |
| 8.  | Attributes         | Non-electrical, non radioactive, explosion proof, easy installation 11.000 LA ASTM E 162 flame index: 22.88   |
| 9.  | Maintenance:       | None  |
| 10. | Listing Reports:   | Underwriters Laboratories Listed Pursuant to Standard UL 1994, Low Level Pathway & Low Level Exit Markings California State Fire Marshal<br><br>Listing #6210-1371;101, US Test Report #182556-1. |

B. Low Level Exit Marker Model 13.100, Aluminum, manufactured and represented by Active Safety, 5 E 4800 S, Suite 100, Salt Lake City, Utah 84107, (800) 657-6324.

- |    |              |  |
|----|--------------|--|
| 1. | Marker Size: | 7" height<br>13" width<br>3/8" depth single-face<br>1-1/8" depth double-face |
|----|--------------|--|

- |     |                  |   |
|-----|------------------|---|
| 2.  | Letter size:     | 3/4" stroke with 6" height  |
| 3.  | Letter Color:    | Green or Red  |
| 4.  | Background:      | Green illuminating  |
| 5.  | Mounting:        | Surface snap mount: snap -on clips attach to wall, sign snaps onto clips.   |
| 6.  | Activation:      | 3-5 foot candles ambient lighting   |
| 7.  | Directional:     | Field applied vinyl arrow as required   |
| 8.  | Life expectancy: | Twenty y-five years+  |
| 9.  | Construction:    | Aluminum extrusion with self-illuminating coating   |
| 10. | Maintenance:     | None  |
| 11. | Attributes:      | Non-electrical, non radioactive, explosion proof, ASTM E 162 Flame spread Index: 22.88  |
| 12. | Listing Reports: | Underwriters Laboratories Listed Pursuant to Standard UL 1994, Low Level Pathway & Low Level Exit Markings California State Fire Marshal<br><br>Listing #6210-1371;101. |

## 2.09 MAIN ENTRY SIGN

### A. Main Entry Sign:

1. Main Entry Sign shall be as indicated on the drawings, non-illuminated type by Vomar Products Inc., 15850 Strathern Street, Van Nuys, California 91406: Phone: (818) 786-8085, or approved equal.
2. Provide framing and support as indicated and required.

## PART 3 – EXECUTION

### 3.01 PREPARATION

- A. Layout: Accurately layout work to maintain proper lines, levels, and spacings.

### 3.02 INSTALLATION, PLASTIC PLAQUES & SIGNS

- A. General: Typically for wall mounted signage, layout signage location and verify plumb and level. Mark and drill holes for plastic anchor inserts and install plastic anchors. Apply silicon sealant to back of sign surface and press to wall surface using caution not to extrude excess sealant onto adjacent finished wall surfaces. Install vandal-resistant screws through face of sign. (Verify sign insert can be removed from backing frame for changing "window" inserts.) Where having to mount sign to glazed window surface, press tape firmly to frame surface, and secure each plaque to glazing surface adjusting to plumb and level installation.
- B. Mounting Location:
  1. General:
    - a. At heights and locations as prescribed by Code. Installation locations shall typically comply with ADAAG (4.30.6).
    - b. As indicated on drawings.
    - c. Multiple Signs: Where more than one sign occurs in one area, group signs vertically, one above the other with 3/4" space between signs, field verify with Architect before installation.

2. Mount following signs or plaques on doors:
  - a. Toilet Room: HDCP figure/geometric symbol at 60" above finished floor.
  - b. Fire Alarm Signs: As field directed by Architect.
  - c. Fire Extinguisher Signs: As field directed by Architect.
  
3. Mount following signs or plaques on walls:
  - a. Typical signs: Room Name plaques and Room Number plaques at 60" above finished floor adjacent to strike jamb of door per ADA & DSA/ACS requirements and as directed by Architect.
  - b. Toilet Room Wall: HDCP figure symbol signs as indicated or as directed at 60" above finished floor.
  - c. Building Entrance: HDCP figure symbol building entrance sign(s) as indicated on drawings or as directed by Architect.
  - d. Other HDCP Symbol Signs: Mount as indicated on Drawings and/or as directed by Architect.

(1) Wheelchair lift.

### 3.03 SCHEDULE; REQUIRED PLASTIC PLAQUES

#### A. General:

1. Certain plaques and signs are listed herein.
2. Other plaques and signs may be shown on drawings and details.
3. Contractor shall provide all items.

#### B. List Of Certain Plaques & Signs:

1. Room Name & Number Plaques:
  - a. One sign for each doorway; as directed by Architect and District.
  
2. Fire Alarm Signs: One for each room that contains a fire alarm station; mounted on exterior face of exterior door to that room.
  
3. Plastic HDCP Accessibility Symbol Signs:
  - a. Toilet Room Door Signs: One for each Accessible Toilet Room.
  - b. Toilet Room Wall Signs: One for each Accessible Toilet Room.
  - c. Building Entrance Signs: One for each Accessible Building Entrance/Exterior Door. Locate where indicated on drawings or as directed by Architect.
  - d. Wheelchair Lift Sign(s): One for each wheelchair lift.
  
4. Fire Extinguisher Signs: One for each room that contains a fire extinguisher; mounted on exterior face of exterior door to that room.
  
5. Directional Signage at each corner, staircase and decision point as necessitated by the path of travel from the Administration area to all Classrooms.



### 3.04 CLEANING & PROTECTION

- A. Cleaning: At completion of installation, clean surfaces in accordance with manufacturer's instructions.
- B. Protection: Protect installed signs from damage until acceptance by the owner.

### 3.05 ACCESSORIES

- A. Install software on school site computer. Set-up and train staff on use of software and printing of labels. Deliver full box (minimum count of 100 sheets) of weather resistant vinyl coated label paper for site use.

**END OF SECTION**

**SECTION 10 44 16  
FIRE EXTINGUISHERS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.
- C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.4 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: **Six** years from date of Substantial Completion.

**PART 2 - PRODUCTS**

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - h. Larsen's Manufacturing Company.
    - i. Moon-American.
    - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
    - k. Potter Roemer LLC.
    - l. Pyro-Chem; Tyco Safety Products.
  2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Clean-Agent Type in Steel Container: UL-rated 1-A:10-B:C, 10-lb (4.5-kg) nominal capacity, with HFC blend agent and inert material in enameled-steel container; with pressure-indicating gage.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Examine fire extinguishers for proper charging and tagging.
  1. Remove and replace damaged, defective, or undercharged fire extinguishers.

END OF SECTION

**SECTION 22 05 00  
COMMON WORK RESULTS FOR PLUMBING**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Requirements of Divisions 0 and 1 apply to work of this section.

1.2 RELATED SECTIONS

- A. This section applies to all sections of Division 22, except as may be otherwise modified in each section.

1.3 FEES, PERMITS AND PAYMENTS

- A. Fees, Permits and Payments: Contractor shall secure permits and inspections and pay full cost of same.

1.4 RELATED WORK SPECIFIED ELSEWHERE

- A. Work designated on drawing or specifications to be installed or performed by other sections of the inspections.
- B. Finish painting: Equipment furnished shall be factory finished. If the factory finish is damaged during shipment, installation, etc., it shall be repainted by the Contractor subject to the Architect's approval.
- C. Electrical connections for motors, line voltage wiring and conduit and low voltage wiring and conduit.
- D. Individual motor controllers except when furnished as integral parts of packaged equipment.

1.5 EQUIPMENT RESTRICTIONS

- A. The proprietary name, and/or model indicated on the drawings, or the first listed for a category in the specifications is the make and/or model used as the basis for design. Bids shall be based on the use of the products of the selected manufacturers. Substitutions will be considered as outlined in General Conditions and Division 1; Section, "Substitutions." Other acceptable manufacturers are named in these specifications.
- B. Choice of Equipment: Equipment has been chosen, which will properly fit into the physical spaces provided and indicated, allowing ample room for access, serving, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with the code requirements and the requirements of the local inspection Department. Physical

dimensions and arrangements of equipment to be installed shall be subject to the Owner's approval. Submit shop drawings of equipment layout for approval where equipment space does not comply with drawings. Changes in piping, motors, wiring, controls, structural or installation procedures required by the substituted product or equipment shall be made at no additional cost to the Owner, and with no reduction in scope.

C. Space Requirements:

1. In the preparation of drawings, a reasonable effort has been made to include equipment manufacturer's recommendations. Since space requirements and equipment arrangement vary according to manufacturer, the responsibility for initial access and proper fit rests with the Contractor. The final arrangement of the equipment and service connections shall allow the unit to be serviced. This shall include space to pull motors, filters, coils, tubes, etc. Make changes in piping and ductwork to suit actual installed equipment without further instructions or additional cost.
2. If the installation of the particular product or equipment, the Contractor has submitted, requires changes in material or size from that required in the contract drawings and specifications, such changes shall be submitted as shop drawings.
3. Contractor shall be aware that some equipment in the mechanical room must be in place before walls and/or roof is installed and shall schedule the installation of equipment accordingly.
4. Contractor shall pay the costs of design (3.0 x direct payroll) and installation of changes resulting from substitution of alternate products. Acceptance of alternate products by Architect does not change this requirement.

1.6 QUALITY ASSURANCE

A. Installer's Qualifications:

1. For the actual fabrication, installation, and testing of work, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturers' current recommended methods of installation.
2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of the installers.

B. Certificates: Execute on behalf of the Owner and deliver to the Architect manufacturers' warranty certificates and instructions, etc. required to assure that the manufacturers' warranties are properly documented and in full effect for the warranty period.

1.7 CODES, ORDINANCES, REGULATIONS AND DEFINITIONS

A. Work and materials shall be in full accordance with the latest rules and regulations of the following Agencies and Codes, the Safety Orders of the Division of Industrial Safety; the California Mechanical Code; the California Plumbing Code; California Fire Code; the California Building Code; California Energy Conservation Code; city ordinances and other applicable laws or regulations.

- B. Nothing in the drawings or specifications is to be constructed to permit work not conforming to these codes. Drawings and specifications shall take precedence when work and materials called for exceed code requirements.
- C. References to Code Specifications shall mean editions in effect at date of proposals.
- D. Reference to technical societies, trade organizations, governmental agencies are made in Mechanical Sections in accordance with the following abbreviations:

AABC	<i>Associated Air Balance Council National Standards for Field Measurement and Instrumentation, Total System Balance</i>
AGA	<i>American Gas Association</i>
AMCA	<i>Air Moving and Conditioning Association</i>
ANSI	<i>American National Standards Institute</i>
ARI	<i>Air Conditioning and Refrigeration Institute</i>
ASHRAE	<i>American Society of Heating, Refrigerating, and Air Conditioning Engineers</i>
ASTM	<i>American Society of Testing and Materials</i>
AWWA	<i>American Water Works Association</i>
CISPI	<i>Cast Iron Soil Pipe Institute</i>
ETL	<i>Electrical Testing Laboratory</i>
FM	<i>Factory Mutual</i>
IBC	<i>International Building Code</i>
ICC-ES	<i>International Code Council Evaluation Service</i>
IRI	<i>Industrial Risk Insurers</i>
ISO	<i>Insurance Service Organization</i>
NEBB	<i>National Environmental Balancing Bureau Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems</i>
NEC	<i>National Electrical Code</i>
NFC	<i>National Fire Codes</i>
NFPA	<i>National Fire Protection Association</i>
NRCA	<i>National Roofing Contractor's Association</i>
OSHPD	<i>Office of Statewide Health Planning and Development for the State of California</i>

PDI	<i>Plumbing and Drainage Institute</i>
SMACNA	<i>Sheet Metal and Air Conditioning</i>
UL	<i>Underwriter's Laboratories, Inc.</i>

E. Definitions:

APPROVED	<i>As approved by Owner's Representative.</i>
ARCHITECT / ENGINEER	<i>The Architect or Engineer of record for this project. The Architect or Engineer is the Owner's representative regarding preparation, revisions and interpretation of the contract documents.</i>
AS DIRECTED	<i>As directed by the Owner's Representative.</i>
AS REQUIRED	<i>As required by applicable Code requirements; by good business practice; by the conditions prevailing; by the Contract Documents; by Owner, or by Owner's Representative.</i>
AS SELECTED	<i>As selected by Owner's Representative.</i>
BATTERY	<i>Two or more fixtures served from same branch.</i>
BY OTHERS	<i>Work on this Project that is outside the Scope of Work to be performed by the Contractor under this Contract, but that will be performed by Owner, other Contractors or other means.</i>
CERTIFIED TEST REPORTS	<i>Test Reports signed by an authorized official stating that tests were performed in accordance with the test method specified that the results reported are accurate, and that items tested either meet or fail to meet the stated minimum requirements.</i>
CERTIFIED INSPECTION REPORTS	<i>Reports signed by approved Inspectors attesting that the items inspected meet the Specification requirements other than any exceptions included in the report.</i>
CONCEALED	<i>Embedded in masonry, concrete or other construction, installed within furred spaces, or in enclosures.</i>
EQUAL	<i>The Contract documents are based upon the manufacturer and model number indicated on the drawings or specifications. Bidder may propose alternative product but will be considered only if the</i>

*bidder has submitted a base Bid, which is in accordance with the specified product. Alternate proposal shall include complete technical data and itemized price adjustments. Bidder shall assume the responsibility that the alternate product meets the physical, mechanical, electrical, structural, acoustical and architectural requirements of the specified product. Acceptance of an alternate product does not entitle the Contractor to a Change Order to modify architectural, structural, mechanical, electrical, control or any other systems necessary to accommodate the alternate product. The Owner or his representative may reject alternate products.*

EXPOSED	<i>Not installed underground or not concealed as defined above.</i>
FIELD TESTS	<i>Tests or analysis made at, or in the vicinity of the job site in connection with the actual construction.</i>
FURNISH	<i>Supply and deliver to the Project site only, not install (unless required to be installed elsewhere in the Contract Documents). Product must be delivered ready for installation and in operable condition.</i>
INSTALL	<i>Install (services or labor) only, not furnish (unless required to be furnished elsewhere in the Contract Documents). Install means to place in final position, complete, anchored, connected and ready to operate.</i>
LIFE SAFETY SYSTEMS	<i>Systems involved with fire protection: including sprinkler piping, fire pumps, jockey pumps, fire pump control panels, service water supply piping, fire dampers, and smoke exhaust.</i> <i>Systems involved with and/or connected to emergency power supply: including generators, transfer switches, transformers, and circuits to fire protection, smoke evacuation, and emergency lighting systems.</i> <i>Medical and life support systems.</i> <i>Fresh air and relief systems on emergency smoke control sequence.</i>
MAIN	<i>The principal artery of a system of continuous piping or ductwork, to which branches may be connected.</i>
MANUFACTURER'S DIRECTIONS, INSTRUCTIONS,	<i>Manufacturer's written directions, instructions, recommendations, specifications.</i>



RECOMMENDATIONS,  
SPECIFICATIONS

PRODUCT	<i>Materials, systems, equipment and fixtures.</i>
MANUFACTURER'S CERTIFICATE CONFORMANCE	<i>A certificate signed by an authorized manufacturer's official attesting that the material or equipment delivered meets the specification requirements. Manufacturer's representative certificate is not acceptable.</i>
MUST; SHALL; TO; WILL	<i>When used as a directive to the Contractor, these items indicate a mandatory action.</i>
NECESSARY	<i>Essential to completion of work.</i>
OWNER-FURNISHED, CONTRACTOR-INSTALLED	<i>To be furnished by the Owner at its cost and installed by the Contractor as part of the work.</i>
PROVIDE	<i>Shall include "Furnish and install" which means supply, fabricate, deliver, place and connect, complete in place, ready for operational use. When neither furnish, install or provide is stated, "provide" is implied.</i>
REMOVE	<i>To remove item completely including attachments, frames, anchors, fittings, bases, pipes, conduits and supports, capping behind finished surfaces and repairing floors, bases and walls to match color and texture and be smooth with existing adjacent surfaces.</i>
RISER	<i>A vertical waterline supplying two or more fixtures, or batteries of fixtures located in different rooms.</i>
SHOWN	<i>As indicated on the Drawings.</i>
SPECIFIED	<i>As written in the Contract Documents.</i>
SUBMIT	<i>Submit to Owner's Representative.</i>
TESTING LABORATORY	<i>A person or organization whose functions include testing, analyzing or inspecting products and/or evaluating the designs or specifications of such products according to the requirements of applicable standards.</i>
WORK	<i>Work of the Contractor or Subcontractor includes labor or materials (including, without limitation, without equipment and appliance) or both, incorporated in, or</i>

*to be incorporated in the construction covered by the complete Contract.*

## 1.8 SEISMIC RESTRAINT

- A. Design, furnish, and install attachment devices, anchor bolts, and seismic restraints that are required for seismic compliance for all equipment, apparatus, piping, conduit and raceways, ductwork, and other components of the specified systems required by reference codes and standards.
- B. Provide seismic restraint types as described. If the item to be restrained is not listed, select appropriate restraint and submit for approval.
- C. Provide seismic bracing for mechanical, plumbing, and fire protection systems.
- D. Seismic Restraints Requirements
  - 1. For each seismic restraint, provide certified calculations to verify adequacy to meet the following design requirements:
  - 2. Ability to accommodate relative seismic displacements of supported item between points of support.
  - 3. Ability to accommodate the required seismic forces.
  - 4. For each respective set of anchor bolts provide calculations to verify adequacy to meet combined seismic-induced sheer and tension forces.
  - 5. For each weld between structure and item subject to seismic force, provide calculations to verify adequacy.
  - 6. Restraints shall maintain the restrained item in a captive position without short circuiting the vibration isolation.

## 1.9 SUBMITTALS

- A. General: Refer to Division 1.
- B. Project Drawings:
  - 1. The drawings are diagrammatic and indicate the general layout of the equipment.
  - 2. The exact location shall be field determined, after shop drawing review for the installation in available space at the job site.
- C. Equipment Lists and Equipment Brochures and Shop Drawings.
  - 1. Copies: Submit six copies of data as specified hereafter.
  - 2. Items of material and equipment required by this Division shall be reviewed by the Architect prior to the start of work. The Contractor shall submit items requiring such review, allowing ample time for the checking and processing, and shall assume responsibility for delays incurred due to the rejected items. Rejected items shall be resubmitted as specified only. Submittal information covering items shall be neatly bound together into booklets, each booklet containing individual items specified. Separate submittals of individual items are not allowed. Each submittal item shall be identified with

the governing specification section, paragraph, subparagraph, or reference drawings, as applicable.

3. Equipment Lists: Provide name of manufacturer, brand name, and catalog number of each item. Submit complete submittals, at one time, having items arranged in numerical sequence with each item identified by section and article of the specifications. Listing items "as specified" without both name and model or type designation is not acceptable, except pipe and fitting not specified by brand names may be listed "as specified" without manufacturer's name, provided proposed materials comply with specification requirements.
4. Material Brochures: Provide copies of complete description, information and performance data covering materials and equipment, which are specified. Brochures submitted to the Architect shall be published by the manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures not compiled in the following manner shall be returned for re-submittal. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs, which describe several different items other than those items to be used unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified.
5. Shop Drawings:
  - a. Refer to Divisions 0 and 1.
  - b. Provide additional data as specified in Governing Specification Section.
6. Seismic Restraint
  - a. Shop Drawings
    - 1) Where walls and slabs are used as seismic restraint locations, provide details of acceptable methods for restraint of equipment, ducts, conduit and pipe shall be included, with supporting certified calculations.
    - 2) Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
    - 3) A copy of the coordination or contract drawings shall be marked-up with the specific locations and types of restraints shown for pipe, duct, and equipment. Rod bracing and assigned load at each restraint location shall be clearly delineated. Each drawing shall be signed by the same engineer performing the seismic calculations noted below.
    - 4) For ceiling suspended equipment, provide minimum and maximum installation angle allowed for restraint system, as well as braced and un-braced rod lengths at each allowable installation condition.
  - b. Seismic Certification and Analysis
    - 1) Seismic restraint calculations shall be provided for connections of equipment to the structure. Performance of products (such as: strut, cable, anchors, clips, etc.) associated with restraints shall be supported with manufacturer's data sheets or certified calculations. Seismic calculation shall be certified by a Professional Structural or Civil Engineer registered in the State of the project.
    - 2) Seismic restraint calculations shall be based on the acceleration criteria required by local codes. Note: For roof-mounted equipment, both the seismic acceleration

and wind loads shall be calculated; the highest load shall be utilized for the design of the restraints and isolators.

- 3) Calculations to support seismic restraints designs shall be stamped by a professional engineer who is registered in the state where the work is being performed, with at least five years of seismic design experience.
  - 4) Table elevations refer to the structural point of attachment of the equipment support system (i.e., use floor slab for floor supported equipment and the elevation of the slab above for suspended equipment).
  - 5) Analysis shall indicate calculated dead loads, derived loads, and materials utilized for connections to equipment and structure. Analysis shall detail anchoring methods, bolt diameter, embedment and/or weld length.
- c. 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 OSHPD or 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.
- d. 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 with at least five years of seismic design experience responsible for their preparation.
- 1) Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.
    - a) Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 15 Sections 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 spacing. 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) Coordinate seismic-restraint and vibration isolation details with wind restraint details required for equipment mounted outdoors. Comply with requirements in other Division 22 Sections for equipment mounted outdoors.
  - d) Preapproval and Evaluation Documentation: By OSHPD or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).
  - e. 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.
  - f. Welding certificates.
  - g. Qualification Data: For professional engineer and testing agency.
  - h. Field quality-control test reports.
7. Miscellaneous: Prior to installation, submit to Construction Supervisor on the job site, two copies of the following:
- a. Shop Drawings of equipment layouts
  - b. Installation instructions for each piece of mechanical equipment furnished.
  - c. Dimension drawings for mechanical equipment pads and curbs including bolt sizes and locations.
8. Submittals required by these specifications, include drawings, calculations, brochures, samples, etc. shall be submitted as one package. Partial submittals will be returned unprocessed.

D. Record Drawings and Operating and Maintenance Books

1. Record Drawings (Refer to Division 1): On completion of work, furnish the Owner through the Architect, with a complete set electronic record drawings and shop drawings which properly reflect the locations of all equipment, fixtures, piping, ductwork, diffusers, mixing boxes, controls, etc., as actually installed. Where necessary to locate concealed equipment, dimensions, shall be included on these drawings. Maintain a separate set of drawing prints at the job site for such marking of "As-Built" locations. This set shall be updated as the installation work progresses and shall be available to the Architect at job visits. The Contractor shall indicate on the "As-Built" Drawings all deletions in green. Additions, relocations, rerouting and modifications shall be indicated in red.
2. The format shall be AutoCad 2020 or later. A CD with the electronic model will be supplied to the successful bidder for this purpose. Monthly changes shall be made to the drawings on a layer named "record" and the color shall be green. A copy of the model on CD with any "as-built" changes shall be submitted to the Architect along with all payment applications.
3. At the end of the project, the Contractor shall take "as-built" drawings modifying the electronic drawing files to show all changes, modification or additions made during construction. These drawings will become "Record Drawings" to be delivered to the Architect.
4. Final Record Drawings shall include legends, schedules, plans, sections and details.

5. Record Drawings shall be marked on the lower right corner with the following:
  - a. Name of Contractor
  - b. Record Drawings
  - c. Date
  - d. Building Permit Number
  - e. Letter shall be bold and print 1/4 inches high minimum.
6. Contractor shall submit to the Architect, Record Drawings as follows:
  - a. Four CDs (AutoCad 2020 or later)
  - b. One reproducible set of drawings
  - c. Four sets of drawings
7. The Architect will distribute the final Record Drawings as follows:
 

	OWNER	ARCHITECT	ENGINEER
CDs	1	1	1
Reproducible drawing set	1	0	0
Drawing Sets	1	1	1
8. Delivery of complete set of Record Drawings is one condition for the release of Contractor's final payment under the Contract.

E. Operating and Maintenance Books

1. Operating and Maintenance Books (Refer to Division 1): Provide the Owner through the Architect, operating instructions and maintenance data books for all equipment and materials furnished under this Division.
2. Submit five copies of operating and maintenance data books to the Architect for review two weeks before final inspection of the project. Assemble data in a single complete indexed volume and identify the size, model and features indicated for each item, as follows:
  - a. Identification readable from the outside of the cover, stating "Heating, Ventilating and Air Conditioning and/or Plumbing and/or Fire Protection Installation. Owner, by (name of company)."
  - b. Neatly typewritten index near the front of the manual, furnishing immediate information as to location in the manual of emergency data regarding the installation.
  - c. Complete instructions regarding the operation and maintenance of all equipment involved.
  - d. Complete nomenclature of replaceable parts, their part numbers, current cost and name and address of the nearest vendor of replacement parts.
  - e. Valve identification table keyed to valve I.D. number (e.g. V-1) on brass tag attached to each valve. Table shall indicate type of valve, product or service (e.g. domestic cold water), and function (e.g. shut-off, balancing, etc.).
  - f. Copy of guarantees and warranties issued on the installation showing dates of expiration.

## 1.10 EXPLANATION AND PRECEDENCE OF DRAWINGS

- A. For purpose of clearness and legibility, the drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible. The Contractor shall make use of data in contract documents and shall verify this information at building site.
- B. Attention is called to the inclusion of flow diagrams, riser diagrams and details. Diagrams are not for the purpose of giving physical dimensions or locations, but rather to clarify sizes and the interconnections of the piping and of the various units of the process.
- C. Other drawings of the contract set are hereby made a part of these specifications and shall be consulted by the Contractor and his work adjusted to meet the installation conditions.
- D. Drawings indicate required size and termination of pipes and ducts and suggest proper routes of piping and duct to conform to the structure, to avoid obstructions and to preserve clearance. However, it is not the intention to indicate necessary offsets and it shall be the responsibility of the Contractor, under this section, to install ductwork and piping in such a manner as to conform to structure, avoid obstructions, preserve headroom, keeping openings and passageways clear, and make equipment requiring inspection, maintenance and repair accessible without further instructions or extra cost to the Owner.
- E. Changes in location on piping, apparatus and equipment as indicated on the drawings shall be made to meet the architectural and structural conditions as required and acceptable to the Architect. Changes in work which has not been installed shall be made by Contractor without additional compensation, except changes which are caused by architectural and structural changes which increase the lengths of pipe or duct runs.
- F. Contractor shall coordinate with other trades so that no interferences shall occur, as no extras will be allowed for changes made necessary by interferences with the work between trades.
- G. CAD files plots and reproductions for this project are the property and instruments of service of dHA+CALPEC. dHA+CALPEC reserves and retains copyright authority, privileges and rights.
  - 1. Upon request and subject to some limitations dHA+CALPEC with their client's approval, may allow contractors and/or vendors to acquire and use copies of the electronic media file data for preparation of:
    - a. Fabrication of shop drawings for this project.
    - b. Submittals pertaining to this project.
    - c. Record documents.
  - 2. Applicable limitations include:
    - a. The Contractor or vendor acquiring these files agrees to hold harmless dHA+CALPEC, the Architect and Owner from liability and/or damages resulting from their use.
    - b. The Contractor or vendor acquiring these data files assumes full responsibility for their use and for the correctness of any information or features contained therein.
    - c. dHA+CALPEC does not warranty, (explicit or implied) the accuracy of the building backgrounds, or dimensions or features contained therein.

- d. Usage is limited to this specific project and the specific acquirer.
- e. The files are released solely for the convenience of the contractor or vendor acquiring same and CAD files may not be transferred to third parties without written prior approval.
- f. dHA+CALPEC shall remove seals, proprietary identification, etc.

#### 1.11 COMPLETE PERFORMANCE OF WORK

- A. Practices of the Trades: Work shall be executed in strict accordance with the best practice of the trades by competent workmen.
- B. Complete Functioning of Work: Labor, materials, apparatus, and appliances essential to the complete functioning of the systems described and/or indicated, or which may be reasonably implied as essential, whether mentioned in these contract documents or not, shall be furnished and installed by the Contractor. In cases of doubt as to the work intended, or in the event of need for explanation thereof, the Contractor shall call upon the Architect for supplemental instructions.
- C. Work not shown in complete details shall be installed in conformance with accepted standard practice.

#### 1.12 CONTROL AND OBSERVATION

- A. The Architect and Owner shall have the right to reject materials or workmanship, which in their opinion are not in accordance with this contract, to interpret contract provisions and the meaning of the drawings and specifications. The above named parties shall be allowed access to the work for observation at all times.
- B. Defective work or work contrary to the contract documents may be rejected without regard to state of completion, even though said work has been accepted as a result of a previous observation.

#### 1.13 APPROVALS

- A. Electrical equipment shall meet the listing requirements and bear a minimum of one of the following agency labels:
  - 1. Underwriter's Laboratories (UL)
  - 2. Electrical Testing Laboratories (ETL)
- B. No equipment will be accepted on the jobsite without prior written approval.

#### 1.14 GUARANTEES

- A. In addition to specific guarantees mentioned in these specifications, the Contractor shall leave the entire installation in complete working order and free from defects in materials, workmanship or finish. Contractor shall repair or replace at his own expense work or parts of



work that may develop defects due to faulty material or workmanship during the tests and within a period of one year after the work is accepted by the Owner. Contractor shall guarantee also to repair or replace with like materials existing work of the building or equipment, which is damaged during the repairing of such defective apparatus, materials or workmanship. The signing of the contract for his work covered by these specifications and of which they shall become a part, shall become a written guarantee on the part of the Contractor to carry out the provisions of this section of these specifications.

#### 1.15 SEISMIC RESTRAINT 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 CBC 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 with at least five years of seismic design experience.

#### 1.16 DAMAGE BY LEAKS

- A. During the time period from the date of contract until termination date of this guarantee, the Contractor shall be responsible for damages to the ground, walls, roads, building, piping systems, electrical systems, heating, ventilating and air conditioning systems, building equipment, furniture and other building contents caused by leaks in the piping systems or equipment being installed or having been installed by him. Repair work shall be done as directed by, in a manner satisfactory to the Owner at no additional cost to the Owner.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Standard of Quality: Materials and equipment shall be new and in good condition. The commercially standard items of equipment and the specific names mentioned in sections of Division 22 are intended to establish the standards of quality and performance necessary for the proper functioning of the mechanical work.

- B. Variations: Since manufacturing methods vary, reasonable minor equipment variations are expected; however, performance and material requirements are minimum. The Architect retains the right to judge equality of equipment that deviates from the specifications.
- C. Symbols are for identification. Symbols, capacities, sizes, and electrical characteristics are indicated on the drawings. Contractor shall make necessary provisions for installation of his equipment and for attaching or connecting his work to other trades.

## 2.2 FLASHINGS

- A. Make pipes and vents passing through roof or outside wall waterproof with flashings and storm collars or counter flashings.
- B. Except as otherwise noted or required, extend vent pipes passing through roof at least 12 inches above finished roofline.
- C. Furnish and install on each pipe passing through the roof a galvanized sheet metal flashing assembly with eight-inch skirt.
- D. Furnish and install on each pipe passing through the roof a six-pound seamless lead flashing assembly with eight-inch skirt. Flashing shall have steel reinforced conical boot and be complete with open top cast iron counter flashing and permaseal waterproofing compound. For sanitary vent, provide a hood with a minimum 2 to 1 free area to vent pipe size.

## 2.3 PIPE SLEEVES

- A. Provide pipe sleeves for mechanical piping.
- B. Size pipe sleeves to permit placing pipe and specified isolation material for pipes passing through concrete or masonry walls or concrete slabs.
- C. Sleeve for pipes through floor slabs standard weight black steel pipe with top of sleeve projecting 3" above finished floor. For waterproof sleeves, use J.R. Smith Fig. 172 or equivalent by Zurn or Josam.
- D. Sleeves for pipes through walls shall standard weight black steel Schedule 40 pipe with ends flush with wall surfaces.
- E. Seal pipes passing through fire rated walls or roofs. Use Dow Corning 3-6548 Silicone RTV Foam in the annular space between pipes and sleeves. Sealant through fire rated walls or roofs shall be rated with the same fire rating as the wall or roof.
- F. Insulated pipe shall be insulated in sleeves, caulked and sealed as above. Use type CS-CW inserts as manufactured by Pipe Shields, Inc.
- G. Pipes passing through exterior walls and concrete walls shall be sealed watertight with "Linkseal" as manufactured by Thunderline Corp. Method of installation as recommended by the manufacturer.

## 2.4 PIPE ISOLATORS AND COVERING PROTECTION

- A. Pipe isolators: Provide each hanger or clamp for un-insulated piping with an isolation material, having metal backing, to isolate sound vibration and electrolysis. Provide Elcen "Isolator or appeared equal." Isolator not required for fire protection automatic sprinkler piping, waste, vent and natural gas piping.

## 2.5 ESCUTCHEONS

- A. Provide heavy chrome-plated or nickel plated plates or approved pattern on pipe passing through floors, walls and ceilings in finished areas. Escutcheons shall be chrome-plated steel plates with concealed hinges and setscrew. Pattern shall be approved by the Architect.

## 2.6 CORROSION PROTECTION

- A. Prior to delivery to the job site, wrap buried steel pipe with corrosion protective wrap of pressure sensitive polyvinyl chloride or polyethylene tape applied after pipe has been thoroughly cleaned. Tape shall be nominal thickness of 20-mil consisting of one layer of 20-mil tape or two separate layers of 10-mil tape. Apply with suitable primer adhesive recommended by manufacturer.
- B. Tightly apply tapes with 1/2-inch minimum uniform lap, free from wrinkles and voids. Use approved wrapping machines and experienced operators.
- C. Tapes: "Chasekote" No. 775, Plicoflex No. 340-25, Polyker 922 and 923, "Scotchwrap" No. 51 or equal. Apply tape after pipe is cleaned as recommended by the tape manufacturer.
- D. Cover filed joints and fittings by wrapping polyethylene or polyvinyl tape specified for wrapping piping, except use two layers of 10-mil thick tape. Wrap joints to provide minimum of six-inches over adjacent pipe covering. Where fittings are wrapped, width of tape shall not exceed two inches. Apply adequate tension so tape will conform tightly to contours of fittings. Use putty tape insulation compounds such as "Scotchfil" or equal to fill voids and provide smooth even surface for application of tape wrap.
- E. Alternate: In lieu of tape wrap, factory applied plastic coating on steel pipe will be acceptable. Use tapes for field joints, fittings and valves same as specified above. Pipe Coating: "X-Tru Coat" (20-mil thick) as manufactured by Standard Pipe Protection, Republic, Pipe Line Service Corp., Scotchkote 202 (12-mil thick) as manufactured by 3M Company, or equal, with "X-Tru-Tape", or equal, for joints and valves.
- F. Test wrapped or coated pipe, fittings and field joints on job site, after assembly, with approved high voltage holiday detector Tinker and Razor, or equal, with positive signaling device to indicate any flaws, holes or breaks in wrapping. Set peak voltage to 10,000-Volt. If Scotchkote 202 is used, set peak voltage to 1,000-Volt. Place piping on temporary blocks to allow testing to run along underside of pipe. Repair defects before covering. Conduct testing in presence of Architect.
- G. No special precautions are required for copper or plastic piping below grade.

- H. Special wrapping is required for contact with concrete such as thrust blocks or floor slabs. Piping shall be wrapped with minimum 8-mil thick polyethylene plastic sheets.

2.7 ACCESS COVERS AND ACCESS DOORS

- A. Access covers and doors locations shall coordinate with Architect.
- B. Provide access covers over under floor buried mechanical valves, controls, clean outs, located in interior and exterior floor and grade areas.
- C. Provide access door over concealed mechanical valves, controls, duct coils, dampers, fire dampers, pipe chases, concealed mechanical equipment through fire rated walls and ceilings.
- D. Provide access doors for access to mechanical equipment valves.
- E. Provide rated access covers or doors when required by the ceiling and wall fire rating.
- F. Access covers – Interior concrete floors:
  - 1. Type: Square or rectangular frame with hinged and secured cover.
  - 2. Size: Nominal 10 x 10-inch.
  - 3. Construction: Aluminum alloy frame and hinged score rated XH cover with lifting device. Secure with vandal proof screws.
  - 4. Marking: Cast cover with words “CLEANOUT”, “GAS SHUT-OFF” or “WATER SHUT-OFF” when used for these services.
  - 5. Acceptable manufacturers: Smith No. 4915, Zurn, Josam.
- G. Access Covers – Interior vinyl floors:
  - 1. Type: Square or rectangular frame with recessed cover.
  - 2. Size: Nominal 10 x 10-inch.
  - 3. Construction: Aluminum alloy frame and tile recess XH cover with lifting device. Secure with vandal proof screws at each corner.
  - 4. Acceptable manufacturers: Smith No. 4920, Zurn, Josam.
- H. Access Doors – Walls and ceilings:
  - 1. Type: Flush or recessed panel.
  - 2. Size: Minimum 12 x 12-inch nominal door for hand access, minimum 16 x 20-inch nominal door for personal access.
  - 3. Location and style:
 

Masonry/concrete walls	Milcor “M” Standard
Gypsum wallboard walls and ceilings	Milcor “M” Standard
Plastered surfaces (except toilet walls)	Milcor “K” Standard
Tile/terrazzo/toilet room walls (with casing bead stainless)	Milcor “M” Standard
Acoustical tile (check type of ceiling system)	Milcor “A”

- |   |                     |
|---|---------------------|
| General areas                               | Milcor "M" Standard |
| Fire rated shafts, rated walls and ceilings | Milcor "B" Standard |
4. Material:
    - a. Stainless Steel, No. 302 with No. 4 finish.
    - b. Standard manufacturer's standard construction and finish for type specified.
  5. Locking:
    - a. Screwdriver: Flush screwdriver operated with case hardened cam.
  6. Acceptable Manufacturers Milcor, Zurn, Miami, Carey, Potter-Roemer.

## 2.8 SEISMIC-RESTRAINT DEVICES

- A. Basis-of-Design Product and Systems: Subject to compliance with requirements, provide Mason Industries or a comparable product by one of the following:
  1. Kinetics Noise Control
  2. Loos & Co.; Cableware Division
  3. Mason Industries
  4. TOLCO Incorporated; a brand of NIBCO INC.
- B. Provide seismic restraints and seismic bracing equipment and systems as described in Part 3 and the Mason Industries Seismic Restraint Guidelines for acceptable restraint methods and OSHPD approved details.
- C. Seismic Restraint Types
  1. Type I: Restrained Spring Mount, Mason SLR-A. Isolator shall incorporate snubbing restraint in all directions, and be capable of supporting equipment at fixed elevations during installation.
  2. Type II: Resilient Seismic Snubber. Mason Z-1011. Each corner or side of equipment base shall incorporate a seismic restraint having a minimum of 5/8-inch thick, all directional resilient pad limit stop. Restraints shall be fabricated of plate, structural members or square metal tubing. Angle bumpers are not acceptable.
  3. Type III: Cable or Brace Restraint. Mason SCB and SSB. Multiple metal cable or steel strut type with approved fastening devices to equipment and structure. System to be field bolted to deck or overhead structural members using two sided beam clamps or appropriately designed inserts for concrete.
  4. Type IV: Spring Neoprent Hanger. Mason 30N. Double deflection neoprene isolator min. 0.15-inch encased in ductile iron or steel casing.
  5. Type V: Non-isolated equipment shall be field bolted or welded (powder shots not acceptable) to the structures as required to meet seismic forces. Bolt diameter, imbedment data, and/or weld length must be shown in certified calculations as noted above.
- D. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by OSHPD or 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.
- E. 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.
    - a. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
  2. Maximum 1/4-inch air gap, and minimum 1/4-inch thick resilient cushion.
- F. Channel Support System: 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.
- G. Restraint Cables: ASTM A 603 galvanized or 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.
- H. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- I. 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.
- J. 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.
- K. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water resistant neoprene, with a flat washer face.
- L. 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.
- M. 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.
- N. Factory Finishes
1. Finish: Manufacturer's standard prime-coat finish ready for field painting.
  2. Finish: Manufacturer's standard paint applied to factory-assembled and - tested equipment before shipping.
    - a. Powder coating on springs and housings.

- b. Hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
- c. Baked enamel or powder coat for metal components on isolators for interior use.
- d. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

### **PART 3 - EXECUTION**

#### **3.1 SUPERVISION**

- A. The Contractor shall furnish the services of a Superintendent experienced in the work of each section who shall be constantly in charge of the progress of the work, together with all the necessary journeymen, helpers and laborers required to properly unload, erect, connect, adjust, start, operate and test the work involved.

#### **3.2 PROTECTION, CARE AND CLEANING**

- A. The premises shall be maintained as required by Division 1.
- B. Materials and Equipment:
  - 1. Effectively protect materials and equipment to be installed on a project against moisture, dirt and damage during the construction period, to the entire satisfaction of the Owner. Special care shall be taken to provide protective and similar equipment that are particularly vulnerable to grit and dirt.
  - 2. Keep interior of ductwork free of dirt, grit, dust, installation and other foreign materials. Do not operate air distribution equipment until building is cleaned and air filters installed in order to prevent soiling of diffusers, ducts, air handling equipment, and buildings. Provide new set of filters after final acceptance of air distribution systems.
  - 3. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out valves, traps, strainers, and demonstrate the cleanliness to the Owner.

#### **3.3 DISPOSITION OF MATERIALS**

- A. Refer to Divisions 1 and 2.

#### **3.4 CLEAN-UP**

- A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage on pavement, streets, or adjacent areas. Limits to 3/4-cubic yard capacity buggies or other conveyances used roofs and within the building to transport removed debris. Clean up spillage from pavement, streets and adjacent areas.

### 3.5 INSTALLATION

- A. General: Inspect the architectural, structural, plumbing, fire protection, special systems and HVAC drawings and specifications to become familiar with the building construction and to coordinate with the work of others.
- B. Piping: Install in strict accordance with manufacturer's written installation instructions and recommendations. Install in a manner that permits expansion and contraction caused by changes in temperature and pressure. Provide additional support as required. Run pipes straight and true, parallel to or at right angles to the building walls. Springing or forcing piping into place will not be permitted.
- C. Fixtures and Equipment: Install in strict accordance with manufacturer's written installation instructions and recommendations. Fixtures (except for handicapped) shall be roughed in only from fixture manufacturer's certified "Rough-In Measurement Drawings" which shall be submitted to the Architect for approval. Handicapped fixtures shall be installed in accordance with 2007 California Building Code rough-in measurements adjusted from manufacturer's certified drawings.

### 3.6 STAGING AND HOISTING

- A. Provide hoisting equipment, staging scaffold, ladders, barricades, shores or similar facilities required to properly carry out this work in accordance with all safety regulations.

### 3.7 EXCAVATION AND BACKFILL

- A. The Contractor shall do necessary excavations and backfill for the installation of work included in his contract.
- B. Excavation: Bury piping outside the building to a depth of not less than 3-ft below finish grade unless otherwise noted.
- C. Excavations shall be as narrow as possible and shall be braced and supported as prescribed by the State Industrial Safety Commission. Excavations shall be cleared of roots and other organic substances and debris. Debris and surplus earth shall be removed from the site. Excavations shall be maintained free of water.
- D. Backfill shall not be more than six-inch thick layers of properly dampened and solidly iron tamped approved earth or backfill material to a density of 90% compaction. Compacting by puddling will not be permitted.

### 3.8 ENCLOSURES AND BARRICADES

- A. The Contractor shall provide, install and maintain for the duration of the work as required, lawful and necessary barricades and railings, lights, warning signs and signals and shall take other precautions as may be required to safeguard persons, the site and adjoining property, including improvements thereon, against injuries and damages of every nature whatsoever.



This requirement applies continuously (24-hours, 7-days a week) for the duration of this contract and is not limited only to regular working hours.

### 3.9 CONTROL AND INSPECTION

- A. The Architect or Owner shall have the right to reject materials and workmanship which in his opinion are not in accordance with this contract, to interpret contract provisions and the meaning of the drawings and specifications.
- B. The above named parties shall be allowed access to the work for observations at all times.
- C. Defective work contrary to the contract documents may be rejected without regard to state of completion, even though said work has not been rejected as a result of a previous observation.

### 3.10 SLEEVES, CUTTING AND PATCHING

- A. The Contractor shall be responsible for the sizing and timely placing of sleeves of piping and insulation material passing through walls, partitions, beams, floors and roof while same are under construction. If a pipe is insulated, its pipe sleeve shall be larger than the outside diameter of the insulation around the pipe. Sleeves set in concrete floor construction shall be minimum 20-gage galvanized steel. If holes and/or sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no expense to the Owner by parties approved by the Architect.
- B. Openings into existing masonry shall be core drilled or saw cut. The Contractor shall undertake no cutting or patching without first securing the Architect's written approval. Where a pipe passes through a sleeve, provide 1/2-inch minimum clearance. No joint of the pipe (or its insulation) shall touch the sleeve. Caulk around such pipe with sufficient layers of 1/8-inch neoprene and seal off opening between pipe and sleeve with non-hardening mastic.
- C. Caulking in fire walls or floors shall be made using a UL listed, fire-rated material. For pipe or conduit penetrations through fire rated floors, walls, partitions, ceilings, etc., provide firestop system complying with the UL "Fire Resistance Directory" for "Through Penetration Firestop Systems" (XHEZ).

### 3.11 ANCHOR BOLTS

- A. Furnish and install anchor bolts for equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates. When equipment is placed on vibration isolators, the equipment shall be secured to the isolator and the isolator to the floor, pad, or support as recommended by the vibration isolation Manufacturer.

### 3.12 INSTALLATION OF VALVES

#### A. General:

1. Valves shall be full line size unless otherwise noted. Automatic control valves are exempted.
2. Valves shall have proper clearances for handle operation and shall close tight at the specified test pressure.
3. Pump discharge check valves shall be of non-slam type.

#### B. Arrangement

1. Valves shall be installed in the systems so located, arranged and operated as to give complete regulation of apparatus, equipment and fixtures.
2. Valves shall be installed for accessibility and easy maintenance.
3. Gate valves shall be installed with stems horizontal to vertically upright.
4. Provide valve box at each valve in ground. Set cover flush with finished grade except in planted areas set 1-inch above grade.
5. Balance Valves: Install balance valves where shown and on each circulating return branch where two or more branches occur on domestic hot water system.
6. Provide readily accessible lubricated gas shut-off valve in gas supply to each gas burning appliance and ahead of union connection thereto, and in addition to valves on the appliance. Locate within 3-ft 10-inch of appliance.
7. Compression Stops: Install stop valve or compression stop on water supply lines to each plumbing fixture, including hose faucets. Where fixture from trim is specified with integral built-in stops, individual supply stops will not be required. Unions are not required adjacent to compression stops.
8. Hose Faucets: Mount with outlet 18-inch above finished grade or 12-inch above finished floor, unless shown otherwise.

#### C. Location:

1. In branches and/or headers of water piping serving a group of two or more plumbing fixtures.
2. On both inlet and outlet of all apparatus and equipment.
3. For shutoff of branch mains.
4. For flushing and sterilizing the systems.
5. Where shown on the drawings.
6. Ahead of each automatic control or regulation valve in water lines.

### 3.13 PIPE SUPPORTS

#### A. Installation:

1. Securely support piping from building construction with manufactured iron hangers, brackets, trapezes, guides, anchors and sway braces to maintain pipe alignment and prevent sagging, noise and excessive strain due to uncontrolled movement under operating conditions. Auxiliary secondary beams shall be furnished and installed under this division of the specifications wherever necessary to meet the requirements above.

2. Piping supports for each system shall be engineered as a system and the proposed system submitted for review.
3. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.
4. Support of piping by wire, rope, wood or other make shift devices will not be permitted.
5. Burning of holes in beam flanges or narrow members will not be permitted.
6. Where calculated maximum travel due to thermal expansion exceeds 1 inch, provide rollers at supports.
7. Piping shall not be supported from roof decking. Furnish and install auxiliary steel members to span steel purlins to distribute the load. Refer to roof shop drawings for location of beams and purlins.
8. Sheet lead, lead wool or wood plugs shall not be accepted as a substitute of cinch anchors as a means of attaching materials and equipment to concrete.
9. Support for insulated pipe shall be outside the insulation. Protect pipe insulation at every hanger, support or guide with inserts and shields. The galvanized sheet shield shall be applied between the hanger or support and the pipe insulation. Provide saddles at all rollers of insulated pipe not equipped with inserts and shields.

### 3.14 SEISMIC RESTRAINT

#### A. Examination

1. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
2. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

#### B. Applications

1. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by OSHPD or an agency acceptable to authorities having jurisdiction.
2. 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.
3. 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.

#### C. Seismic Restraint Installation

1. Install seismic restraint devices as necessary to meet AHJ requirements.
2. Piping Restraints:
  - a. Comply with requirements in MSS SP-127.
  - b. Space lateral supports a maximum of 40-ft on center, and longitudinal supports a maximum of 80-ft on center.
  - c. Brace a change of direction longer than 12-ft.

3. Install cables so they do not bend across edges of adjacent equipment or building structure.
4. Install seismic-restraint devices using methods approved by OSHPD or an agency acceptable to authorities having jurisdiction providing required submittals for component.
5. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
6. 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.
7. 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.
8. Drilled-in Anchors:
  - a. 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 pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
  - b. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - c. 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.
  - d. 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.
  - e. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - f. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.
9. Seismic Restraint Application
  - a. Suspended pipe, duct, cable trays, bus duct and conduit shall be restraint Type III or V.
  - b. For trapeze supported piping and conduit, the individual pipes and conduits shall be transversely and vertically restrained to the trapeze support at each restraint location.
  - c. For overhead supported components, overstress of the building structure must not occur. Bracing shall occur from:
    - 1) Flanges of structural beams
    - 2) Upper truss chords in bar joists.
    - 3) Cast in place inserts or drilled and shielded inserts in concrete structures.
  - d. Pipe Risers
    - 1) Where pipes pass through cored holes, core diameters shall be a maximum of 2-inch larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or firestop as specified in other sections of this specification and/or state and local codes. No additional horizontal seismic bracing is required.

- 2) Non-isolated, constant temperature pipe risers through cored holes require a riser clamp at each floor level on top of slab attached in a seismically approved manner for vertical restraint.
  - 3) Isolated and/or variable temperature risers through cored holes require Type K riser resilient Guides and Anchors installed to meet both thermal expansion and seismic acceleration criteria. Each floor level shall have either a riser clamp that does not interfere with the thermal expansion/contraction of the pipe or a riser clamp/cable assembly (also non-interfering) capable of supporting the weight of the pipe between floors in the event of pipe joint failure. Riser guides and anchors shall also be selected to serve as seismic restraints.
- e. Chimneys, stacks and boiler breaching passing through floors shall be bolted at each floor level or secured above and below each floor with riser clamps.
  - f. Non-isolated floor or wall mounted equipment and tanks shall use restraint Type III or V.
  - g. Where base anchoring of equipment is insufficient to resist seismic forces, restraint TYPE III shall be located above the component's center of gravity to suitably resist "G" forces specified. Vertically mounted tanks and upblast tubular centrifugal fans, tanks, or similar equipment, may require this additional restraint.
  - h. A rigid piping system shall not be braced to dissimilar parts of building on two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and roof; solid concrete wall and a metal deck with lightweight concrete fill, pipes, duct, conduit, etc., crossing a building expansion joint.

#### D. Exclusions From Seismic Restraint Requirements

1. With the exception of life safety components, certain components do not require seismic restraints.
2. The exclusions from seismic restraint requirements DO NOT apply for Life Safety Components as follows:
  - a. Piping: Fire protection, fuel oil, gasoline, natural gas, medical gas, compressed air, medical piping or piping that contains hazardous or corrosive materials that is 1-inch nominal diameter and larger.
3. With the exception of life safety components, the following items do not require seismic restraints:
  - a. Piping less than 2-1/2-inch diameter.
  - b. Clevis or trapeze supported piping suspended by hanger rods less than 12-inch in length (6-inch or less for fire sprinkler piping) with positive attachment to structure.

#### E. Accommodation Of Differential Seismic Motion

1. 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. Comply with requirements in Division 22 Sections HVAC and Plumbing for piping flexible connections.

#### F. Field Quality Control

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

2. Perform tests and inspections.
3. Tests and Inspections:
  - a. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - b. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
  - c. Obtain Architect's approval before transmitting test loads to structure.
  - d. Provide temporary load-spreading members.
  - e. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - f. Test to 90% of rated proof load of device.
  - g. Measure isolator restraint clearance.
  - h. Measure isolator deflection.
  - i. Verify snubber minimum clearances.
  - j. If a device fails test, modify installations of same type and retest until satisfactory results are achieved.
4. Remove and replace malfunctioning units and retest as specified above.
5. Prepare test and inspection reports.
  - a. Upon completion of installation of seismic restraint devices, a certification report prepared by the manufacturer shall be submitted in writing to the contractor indicating that systems are installed properly and in compliance with the specifications. The report must identify those areas that require corrective measures or certify that none exists. Field coordination changes to the originally submitted seismic restraint designs must be clearly defined and detailed in this report.

#### G. Adjusting

1. Adjust isolators after piping system is at operating weight.
2. 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.
3. Adjust active height of spring isolators.
4. Adjust restraints to permit free movement of equipment within normal mode of operation.

#### H. Demonstration

1. 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."

### 3.15 IDENTIFICATION OF EQUIPMENT, PIPING AND VALVES

- A. Equipment Labels: Equipment furnished and installed under this section shall be provided with manufacturers metal labels securely attached to each individual piece of equipment and showing complete and comprehensive performance characteristics, size, model, serial number etc.

- B. Name Plate: Install engraved Bakelite nameplates with 1/4-inch high white letters for equipment, switches, controls, room stats, damper motors, indicating zones, etc.
- C. Valves shall have tags attached with "S" mounting. Tags shall be at least 1-1/2-inch in diameter. Tags shall be stamped with valve I.D. number (e.g. V-1) and be keyed to valve identification table submitted as part of the Operating Instruction and Maintenance Manuals.
- D. Piping exposed to view shall have color coded markers as to type of use, service, and direction of flow in accordance with the latest edition of ANSI A 13.1. Locate markers at each valve, at entries to walls, and on 20-ft centers on straight runs of pipe. Provide a flow arrow at each identification marker. Labels or markers shall be made of plastic sheet with pressure sensitive adhesive suitable for the intended application.
  - 1. Color Coding for Labels and Bands by Hazard Classification:
    - a. Safe Materials – Green:
      - 1) Domestic cold and hot water – green with black letters.
      - 2) City water – green with white letters
    - b. Dangerous Materials – Yellow:
      - 1) Natural Gas – yellow with black letters
      - 2) Industrial cold water – yellow with black letters
- E. Nameplate designations shall correspond to the identifications on the "Record Drawings."
- F. Submit to the Architect for approval a list of items to be tagged within two weeks after award of the Contract.

### 3.16 CLEANING

- A. Equipment, piping, ductwork, and related valves and appurtenances, etc. Clean so as to remove rust, scale, plaster or internal obstructions before covering is installed or piping or equipment is painted. No scarring or disfiguring of equipment, piping, etc. will be acceptable before covering or painting is applied.
- B. Painted Work: Parts of the work, which are to be painted or which are exposed in the finished work shall be thoroughly cleaned and made ready to receive paint finish.
- C. Completion: Upon completion of the work, the Contractor shall remove rubbish, debris and surplus materials, resulting there, from the premises together with test instruments, and equipment and shall leave the site in a neat, clean and acceptable condition as approved by the Architect.

### 3.17 FLUSHING OF PIPE SYSTEMS

- A. Entire pipe systems shall be flushed and cleaned of foreign matter before they are placed in service. The length and number of flushing cycles shall be governed by the complexity of the system, but in no case less than two cycles.

- B. Flushing shall be performed using a similar media that is to be carried by the piping system. (Example: Cold water piping – water; etc.)
- C. Where pipe strainers have been designed or installed into the piping network, said strainers shall be opened and strainer baskets removed and cleaned several times during the flushing of the system.
- D. Chemical Cleaning: For chemical cleaning of closed circuit systems see Section 236000.

### 3.18 CORROSION PROTECTION

- A. Protective coverings for underground steel piping shall be installed in strict accordance with manufacturer's written installation instructions.
- B. Testing: Covered pipe shall be tested with high voltage holiday tester in the presence of Architect prior to backfilling all holidays shall be repaired and retested.
- C. Plastic sleeves, rubber seals, or other dielectric material shall be used to isolate piping from the building structure where steel piping penetrates concrete floor slabs or walls.

### 3.19 PAINTING

- A. Touch-Up: If the factory finish on any equipment furnished by the Contractor is damaged in shipment or during construction of the building, the equipment shall be refinished by the Contractor to the satisfaction of the Architect.
- B. Concealed Materials: Uncoated cast iron or steel that will be concealed or will not be accessible when installations are completed shall be given one heavy coat of black asphalt before concealment.

### 3.20 ELECTRICAL WORK

- A. Furnish electrical interlock wiring diagrams and complete sequences of operation for equipment specified in Division 26 that must interface with other electrical, mechanical, or control equipment. These diagrams shall be submitted to both the mechanical, and electrical engineers for review and coordination.
- B. Furnish any additional line or low voltage, mechanical and control system wiring and conduit required over and above that specified in Division 26 as required for complete and functional systems is hereby specified in this Division in complete conformance with the requirements outlined in Division 26 at no additional cost to the Owner.

### 3.21 PENETRATIONS

- A. Duct and pipe penetrations of ceilings shall be sealed air tight with silicone caulking prior to installation of escutcheon rings.



- B. Duct and pipe walls or slab penetrations shall be sealed using a UL listed fire rated material.

### 3.22 PRELIMINARY OPERATIONS

- A. Should the Owner require that any portion of the system or equipment be operated prior to the final completion and acceptance of the work, the Contractor shall furnish such operation. The expense thereof will be paid, by the Owner separate and distinct from any money paid on account of the contract.
- B. For such preliminary operation, payment shall not be construed as final acceptance of the work of this contract.

### 3.23 OPERATING INSTRUCTIONS

- A. The Contractor shall provide the services of a competent Operating Engineer to supervise the operation of equipment specified herein and to instruct the Owner's operators during a three day operating period. The operating instruction period shall be defined as straight time working hours and shall not include nights and weekends.
- B. The Owner shall be notified in writing at least five days before each operating instruction period begins. The Owner must indicate acceptance of the instructional starting time in writing to the Contractor. Upon arrival, the various instructors shall report to the Owner.

### 3.24 TESTS

- A. Tests must be performed and systems approved prior to painting, covering, insulating, furring or concealing piping.
- B. Provide test equipment, instrumentations and labor in conjunction with tests.
- C. Prior to test, protect or remove control devices, air vent and other items, which are not designed to stand pressure used in test.
- D. Accomplish testing of piping in section so as not to leave a portion of pipe or joint untested.
- E. Obtain prior approval for test procedure.
- F. Responsibility for Damages: Contractor shall pay for costs for repair and restoration of work of other trades damaged by tests or cutting done in connection with tests.

### 3.25 REPAIRS AND RETEST

- A. Refer to related sections.
- B. Make other adjustments, repairs and alterations required to meet specified test results.
- C. Correct defects disclosed by tests or inspection; replace defective parts.

- D. Use only new materials in replacing defective parts; in case of pipe, replace with same length as defective piece.
- E. Repeat tests after defects have been corrected and parts replaced, until pronounced satisfactory.

### 3.26 MECHANICAL SYSTEMS STARTING

- A. Start-up all operating systems provided under Division 22.
- B. Demonstration of all operating systems provided under Division 22, including, but not limited to:
  - 1. Plumbing Equipment, Appliances and Fixtures including but not limited to Hot Water Heaters.
- C. Sequencing: Conduct demonstrations only after systems have been through start-up procedures, systems are complete and operating and operating maintenance data is complete.
- D. Verification of Conditions:
  - 1. Existing conditions: Examine preceding work to ensure that systems are operational.
  - 2. Verify with Division 26 contractor:
    - a. Temporary services are disconnected and permanent utility services are capable of full load.
    - b. Connections in main switchgear and subpanels are tight.
    - c. Necessary tests and check meter readings have been made.
  - 3. Plumbing:
    - a. Specified tests on piping systems have been made.
    - b. Specified cleaning of piping systems has been completed.
    - c. Piping: Conformance with drawings, specifications, and ANSI B31.1. Replace or correct work rejected because of defects or nonconformance with drawings, specifications and ANSI B31.1.
    - d. Water treatment has been completed.
    - e. Operational and performance tests have been made.
    - f. 24 hours and recheck.
    - g. Verify plumbing fixtures operate.
    - h. Verify integrity of wiring.
    - i. Verify sensors are provided and in correct location.
    - j. Verify range of each device and check software is compatible sensor calibration.
    - k. Test voltage on each input and output.
    - l. Test start/stop points to verify correct equipment operates.
    - m. Check sensor calibration.
- E. Submit testing plan for review prior to testing. Indicate order of procedure, list items will be tested and order of testing show where controllers and devices are located.

- F. Provide report indicating equipment operated properly and as per sequence of operation.

### 3.27 START-UP TESTING

- A. Notification: Notify owner at least two days in advance of start-up of mechanical systems.
- B. Start-up and Testing: Conduct start-up and start-up testing in presence of owners. See applicable Division 22 Sections for specific requirements.
- C. Lubrication: Field check and field lubricate equipment requiring lubrication prior to initial operation.
- D. Code Authorities: Complete tests required by code authorities including smoke detection, fire protection and health codes.
- E. Control Systems: Ensure control systems are fully operational in manual and automatic modes.
- F. Test equipment before and after installation as applicable where necessary to determine compliance with specifications.
- G. Start-up and Testing: Conduct start-up and start-up testing in presence of Owner. See applicable Division 22 Sections for specific requirements.
  - 1. Periodically clean various strainers during initial operation until no further accumulation of foreign materials occurs. Exercise care so minimum loss of water occurs when strainers are cleaned.
  - 2. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.
- H. Field Tests: Subject the work of Division 22 to necessary field tests after installation and before acceptance.
  - 1. Make proper corrections, repairs and replacements should tests reveal evidence of malfunction. Repeat tests until proper and successful operation is achieved.
  - 2. If final control settings and adjustments cannot be properly made to performance tests because of time of year, make field tests as first seasonal use of systems following completion of project.
- I. Cleaning and Adjusting: After test runs have been completed and systems have been demonstrated to be satisfactory and ready for permanent operation. Clean permanent pipeline strainers properly adjust valve and pump packings, secure drive guards in place, check lubrication and replenish if required.
- J. Protection: If systems are not to continue in use following start-up procedures, take steps to ensure against accidental operation or operation by unauthorized personnel.
- K. Instruct Owner's representatives once on proper operation and maintenance of mechanical systems. Include seasonal concerns and operations.

- L. Systems: Mechanical systems provided under Division 22. See applicable Division 23 Sections for additional requirements.
- M. Contractor's Representatives: Have thorough knowledge of particular installation and system.
- N. Manufacturer's Representatives: Have thorough understanding of each particular equipment and system.
- O. Scheduling: Arrange and schedule demonstration times with Owner.
- P. Location: Conduct demonstrations at Project including tours of systems.
- Q. Operating and Maintenance Date: Arrange for data to be at demonstrations. Include review of data at demonstrations.

### 3.28 COMPLETION DATE AND TESTING OF PLUMBING SYSTEMS:

- A. Final Acceptance Tests shall be sufficiently in advance of the contract completion date to permit the execution before that expiration of the contract of any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of equipment.
  - 1. Modifications shall be completed within the number of days allotted for completion of the contract. Retests shall not relieve the Contractor of completion date responsibility.
- B. Starting and Operation: Before starting or operating equipment of systems, make through check to determine that the systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced. Notify owner at least three days in advance of starting these tests.

### 3.29 FINAL REVIEW

- A. Date and Time: At a time designated by the Owner, the entire system shall be reviewed by the Architect. The Contractor shall be present at this review.
- B. System Operation: The system shall be operating properly within water and air volumes balanced and all temperature controls adjusted. Labels shall be removed from the plumbing fixtures, and the fixtures shall be cleaned and in operating condition. Air and Water Balance Report shall be submitted to the Owner.
- C. Documentation: Certificates and documents required herein shall be in order and presented to the Architect at least two weeks prior to the review.
- D. Changes and Corrections: After the review, changes or corrections noted by the Architect as necessary for the work to comply with these specifications and the drawings shall be accomplished without delay in order to secure final acceptance to the work.

END OF SECTION

NEW VEHICLE MAINTENANCE FACILITY AT  
SAN GABRIEL HIGH SCHOOL  
ALHAMBRA UNIFIED SCHOOL DISTRICT  
FLEWELLING & MOODY PROJECT NO. 2868.0000

COMMON WORK RESULTS FOR PLUMBING  
22 05 00-34

**SECTION 22 15 00  
PLUMBING**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Section 22 05 00, "Common Work Results for Plumbing" applies to the work of this Section.
- B. The work listed or required by this section of the specifications is not intended to limit or establish the extent of the Plumbing work. The General Contractor shall be responsible for determining the extent of the Plumbing work to be done under a subcontract.

1.2 DESCRIPTION

- A. Work Included: The work includes the furnishing of labor, materials, appliances and tools necessary for the installation, in complete working order, of plumbing systems as herein specified and as indicated on the drawings. The item of work shall include, but not be limited to, the following principal items:
  - 1. Fixtures and equipment included in plumbing schedule or as indicated on the drawings.
  - 2. Soil, waste, grease waste and vent piping systems.
  - 3. Natural gas piping system.
  - 4. Compressed air piping systems.
  - 5. Building storm and overflow drain system.
  - 6. Potable hot and cold water, tempered water, and piping systems.
  - 7. Non-potable hot and cold water, tempered water, and piping systems.
  - 8. Motor Oil piping systems.
  - 9. Sleeves, hangers and seismic bracing for piping systems.
  - 10. Insulation of piping.
  - 11. Testing.
  - 12. Excavation and backfill.
  - 13. Rough-in and final gas and water connections to mechanical equipment including but not limited to the kitchen equipment.
  - 14. All other miscellaneous items and equipment required for a complete installation.
  - 15. Seismic restraints for pipe.

- 16. Rough-in and final gas and water connections to mechanical and kitchen equipment as required.
- 17. Grouting of own base plates is included as part of work in this project.
- 18. Demolition of fixtures, equipment and piping as shown. Demolished items shall become property of contractor (unless otherwise noted) and disposed of off site by contractor.

- B. All other work herein specified and shown on the accompanying drawings including addenda, change order and approved shop drawings.
- C. The Contractor shall furnish other tradesmen with drawings and directions necessary to enable them to properly construct their work so that the systems shall be properly interconnected.
- D. The Contractor shall be responsible for the correctness of his drawings and instructions and make, at his expense, necessary changes in the completed work of other trades made necessary by errors in his drawings or instructions.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Work designated on drawings to be installed or performed by other sections of the specifications.
- B. Finish painting of equipment, piping and ductwork shall be under Division 9 Painting Section, except as noted otherwise.
- C. Equipment foundations, curbs, or equipment pads as provided under the Concrete Section or Structural Steel Section. Coordinate exact foundation sizes and elevations, and anchor bolt sizes and locations.

1.4 EQUIPMENT RESTRICTIONS

- A. Refer to Section 22 05 00

1.5 SUBMITTALS

- A. In addition to the requirements of Section 22 05 00, submittal brochures shall include the following items:

1. Piping Materials:

Waste and Vent	Potable Hot and Cold Water
Tempered Water	Potable Hot Water Return
Non-potable Cold Water	Storm and Overflow Drain
Natural Gas	Compressed Air
Motor Oil	

2. Piping Accessories:

Hangers	Dielectric Couplers
Hanger Supports	Insulation
Hanger Brackets	Water Hammer Arrestors

- |    |                                    |                            |
|----|------------------------------------|----------------------------|
|    | Seismic Restraints                 | Piping Identification      |
| 3. | Valves:                            |                            |
|    | Gate Valves                        | Check Valves               |
|    | Ball Valves                        | Gas Regulators             |
|    | Gas Seismic Valves                 |                            |
| 4. | Access Panels                      |                            |
| 5. | Fixtures and Equipment:            |                            |
|    | Water Closets                      | Urinals                    |
|    | Lavatories                         | Sinks                      |
|    | Floor Sinks                        | Drinking Fountain          |
|    | Floor Drains                       | Trap Primers               |
|    | Hose Bibbs                         | Overflow Drains            |
|    | Storm Drains                       | Roof Receptors             |
|    | Air Compressor                     | Hose Reels                 |
|    | Garbage Disposal                   | Thermostatic Mixing Valves |
|    | Water Heater with Circulating Pump |                            |
|    | Emergency Eyewash and Shower       |                            |
|    | Gas-Fired Steam Pressure Washer    |                            |
|    | Acid Waste Neutralization Tank     |                            |
|    | Waste Hammer Arrestors             |                            |
|    | Sand-Oil Interceptor               |                            |

B. Contractor shall coordinate and provide shop drawings of the following:

1. Plumbing equipment and piping systems show sections indicating routing and clearances between other trades.
2. Potable hot and cold water, non-potable cold water, potable hot water return, tempered water, LAB vacuum, LAB DI water, acid resistant drain and vent, sewer and vent, storm water and gas piping plans and sections (1/4" scale).
3. Dimension drawings for concrete pad, curb and equipment foundations (1/4" scale minimum) including bolt sizes and locations.
4. Steel fabrication drawings for equipment and pipe supports attachments (1/8" scale).
5. Control Wiring Diagrams.

**PART 2 - PRODUCTS**

2.1 GENERAL

- A. Plumbing fixtures, fittings or valves intended to dispense water for human consumption which contain more than 0.25% LEAD are not permitted to be sold or installed anywhere within the State of California. These devices shall be 3<sup>rd</sup> party listed to ANNEX G of NSF/ANSI 61-2008 or



other approved testing standard. Evidence of compliance shall be presented to the Building Inspector prior to final inspection California Health & Safety Code 116875 (AB1963).

## 2.2 PIPING SYSTEMS

### A. Sewer, Waste and Vent Piping, Storm Drain and Overflow Piping:

1. Hub-less cast iron pipe and fitting with stainless steel compression couplings conforming to the requirements of CISPI Standard 301, ASTM A888 or ASTM A74 for all pipe and fittings.
2. Pipe and fittings shall be marked with collective trademark of Cast Iron Soil Pipe Institute and shall be listed by NSF International.
3. Joints for hub-less pipe and fitting shall conform to the manufacture's installation instructions, CISPI Standard 301 and local code requirements. Hub-less coupling gaskets shall conform to ASTM Standard C-654. No-Hub couplings shall be listed by NSF International.

### B. Potable and Non-Potable Cold Water, Tempered Water, Hot Water, Hot Water Return, Compressed Air Piping including but not limited to the condensate drain lines from Mechanical Equipment (above grade or slab):

1. ASTM B88, Type "L" seamless hard drawn copper tubing with ASTM B16.22 wrought copper fittings. Joints shall be soldered with lead-free, tin-zinc alloy solder such as Harris Stay-Safe 50. Flanges, bronze solder joint, ANSI 150 lb.

### C. Potable and Non-potable Cold Water Piping Below Grade:

1. ASTM B88, Type "K" seamless hard drawn copper tubing with ASTM B16.22 wrought copper fittings. Joints shall be brazed with Sil Fos 7.

### D. Motor Oil:

1. Steel pipe, ASTM A53, Schedule 80 and seamless.
2. Fittings: ASTM A181, Grade II; 1000 LB. forged black steel socket weld. Welded joints.

### E. Natural Gas Piping, above Grade:

1. Pipe:
  - a. 2-inch and smaller: ASTM A-53, Schedule 40, black steel.
  - b. 2-1/2 to 6-inch ASTM A-53, Schedule 40, black steel, seamless.
  - c. 8 to 12-inch: ASTM A-53, Schedule 20, black steel, seamless.
2. Fittings:

- a. 2-inch and smaller: Screwed: malleable iron, black, 150-psig unions: Malleable iron, black, ground joint, 250-psig, Grinnel No. 554.
  - b. 2-1/2-inch and larger: Welded only, 3 pass, butt welded fittings.
3. Outdoor Protection:
- a. Steel Piping with Rust and Protective Coating:
    - 1) Apply joint cover kits to pipe after joining to cover, seal, and protect joints
- F. Natural gas piping, exterior (below grade):
- 1. Polyethylene Pipe: ASTM D3350, ASTM D2513, ASTM 02683 and ASTM 3261, pipe designations PE 2708, designed for gas distribution.
- G. Gas Seismic Valves and Regulators:
- 1. Regulator manufacturer based upon Equimeter. Equal products by Fisher, Rockwell or Reliance may be submitted for approval. Regulator shall be capable to reduce the medium gas pressure (from range of 10 Lbs to 5 Lbs) to low gas pressure (8" water column).
  - 2. Balancing diaphragm type with internal relief valve, strainer, vent and automatic shut off.
  - 3. Capacities: as indicated on the drawings.
  - 4. Seismic Valve manufacturer based upon Pacific Seismic Earthquake Valve or equal.
- H. Hangers, Supports, Brackets and Plates:
- 1. Horizontal pipe lines shall be carried by hangers or supports spaced according to the following schedule or supported as required by the Uniform Plumbing Code:
 

Schedule 40 Steel Pipe		Copper Water Pipes	
Size	Max. Spacing	Tube O.D.	Max. Spacing
3/4" – 1"	7'-0"	1" and less	6'-0"
1-1/4" – 1-1/2"	8'-0"	1-1/2" and up 8'-0"	1-1/2" and up 8'-0"
2"	10'-0"		
2-1/2"	11'-0"		
3"	12'-0"		
4"	14'-0"		
5"	15'-0"		
6"	17'-0"		
  - 2. Where two or more lines are run at the same elevation, trapeze hangers constructed of "Unistrut" and rods as herein specified may be used. Provide separate hangers for each branch take-off three feet in length or more. Hangers shall be set so as to allow the pipe to adjust itself to changes produced by expansion and contraction.

3. Hangers for non-insulated pipelines shall be clevis type "Grinnel" Figure 260 or approved equal. Hangers for insulated pipelines shall be a "Grinnell" Figure 300 or approved equal. Hangers shall be supported on threaded rod hangers of the following sizes:

Pipe Size	Rod Size
2" and under	3/8" rods
2-1/2" and 3"	1/2" rods
4"	5/8" rods
5" and 6"	3/4" rods

4. Hanger Isolation: Copper piping lines shall have "Semco" Trisolators between the hanger or bracket and the pipe.
  5. Supports: Supports for vertical piping shall be "Grinnel" Figure 261 or approved equal split clamps bolted around the pipe and resting on the floor slab.
  6. Brackets: Standoff brackets for vertical line of piping and valve assemblies shall be "Secure Strut & Hanger Co." Figure 7 or approved equal offset pipe clamps.
  7. Plates: Where exposed pipes pass through walls, floor and ceilings, they shall be fitted with "Beaton and Caldwell Manufacturing Company" No. 3 – A factory finish split wall plates fastened to the pipe with a set screw. Plates shall be large enough to cover the openings around the pipe.
  8. Seismic Bracing: Where hanger rods on horizontal runs of pipe are 24 inches in length or longer, there shall be one 3/16" x 1" steel stay bolted to each pipe hanger clamp and anchored to the wall or ceiling. Stays to ceiling shall rise at a 45 degree angle and be anchored with 5/16" bolts in chinch lead anchors for concrete construction; for steel construction clamp with beam clamps to beams. Alternate stays shall be installed on opposite sides.
- I. Identification of Piping: Identify and paint exposed piping, with appropriate color-coding as specified in Section 15010.

## 2.3 VALVES

- A. Provide and install valves required for draining and full control of piping and equipment. Valves shall be one of the following makes for the various conditions and positions required: "NIBCO," "Stockham" or "Crane". Valves of one type shall be of one manufacturer.
- B. Unless otherwise indicated, valves of types installed in connection with mechanical piping shall comply with the following:
  1. Valves for natural gas service shall be UL listed and CGA approved.
  2. Pack stems in conformance to ASTM B16.34.
  3. Valves 4" and larger mounted in excess of 7'-0" above the floor in mechanical rooms shall be equipped with chain operators and guides. Extend chains to within 6'-6" of floor.

4. Mark each valve at the factory with the following minimum information, engraved, stamped or cast on each valve or metal tag permanently attached to the valve.
    - a. Manufacturer's name.
    - b. Catalog or figure number.
    - c. Size and pressure class.
    - d. Arrows to indicate direction of flow on check, globe, angle, nonreturn and eccentric plug valves.
    - e. Underwriter's Laboratories (UL) approved valves shall bear the UL label.
  5. Each valve shall be the same size as the pipe in which it is installed.
  6. Provide extended valve stem with tee handle on valves installed in insulated piping.
- C. Bronze Gate Valves: Provide wedge disc pattern with nonrising stem, repackable under full operating pressure when wide open.
1. Provide valves designed for 125 psig stem and 200 psig non-shock water, oil or gas working pressures.
  2. Size 2" and smaller:
    - a. Materials: Provide bodies, bonnets and discs made from bronze conforming to ASTM B62. Stems shall be bronze silicon alloy, ASTM B99.
- D. Ball Valve, two-piece or one top entry bronze body conventional port with [316 stainless steel] or [brass with hard chrome plated] ball, Teflon seats and stuffing box ring, blowout-proof stem with lever handle.
1. Provide valves designed for 125 psig stem and 400 psig non-shock water, oil or gas.
    - a. Size 3" and smaller
      - 1) a. Two-piece lead free bronze body full port with brass with hard chrome plated ball, PTFE seats and stem seals, adjustable packing nut, blowout-proof stem with lever handle. Basis of design, NIBCO S/T-685-80-LF or equal.
- E. Swing Check Valve, bronze body, horizontal swing, Y-pattern with 45° seat regrindable type, with renewable seat and disc.
1. Provide valves designed for 125 psig steam and 200 psig non-shock water, oil or gas.
    - a. Size 3" and smaller

- 1) Lead free bronze body, horizontal swing, Y-pattern with 45° seat regrindable type, with renewable seat and disc. Basis of design, NIBCO S/T-413-Y-LF or equal.
- F. Pressure Reducing Valves: Bronze Body and Bell Housing, nylon reinforced Buna-N diaphragm and renewable stainless steel seat. Wilkins 500 YSBR series, WATTS No. 233S or equal.
- G. Backflow Prevention Devices:
1. Reduced Pressure Principle Type: Cast Iron Body with spring loaded, diaphragm assisted main check valve, a spring loaded second check valve and a spring loaded diaphragm actuated differential pressure relief valve, body rated for 175 psi working pressure complete with two full port resilient wedge gate valves and four resilient seated ball valve test cocks. Stainless steel and bronze corrosion resistant internal parts and replaceable seats.
  2. Double Check Type: Cast Iron body with two independently acting check valves, two gate valves, four test cocks. Body rated for 150 lb. working pressure. Stainless steel and bronze corrosion resistant internal parts and replacement seats.
  3. Arrange for and pay fees for testing and certification of backflow prevention devices by a firm or agency approved by the Owner's Representative.
- H. Relief Valves:
1. Potable Water Temperature and Pressure: On hot water storage tanks provide an American Society of Mechanical Engineers (ASME) rated McDonald Miller, Watts Regulator Co., or equal, thermostatic, self-closing temperature and pressure relief valve, located in the relief valve openings of tanks. Valve shall have a minimum thermal discharge capacity equal to the input capacity of the heater, standard pressure setting of 125 psig and standard temperature setting of 210°F. Route discharge pipe to service sink.

## 2.4 WATER HAMMER ARRESTORS

- A. Stainless steel housing and bellows designed specifically to cushion surges in water supply piping due to sudden on-off operation of valves. Sizes are recommended by Plumbing and Drainage Institute Standard PDI WH-201. Manufacturer: "J.R. Smith" Hydrotol, "Greer" Surge Kushon, or "Wade" shockstops.
- B. Provide access door for arrestors located in the plumbing chases.

## 2.5 INSULATION:

- A. General: Pipe thickness shall conform to Title 24 as a minimum. Use thickness specified, if greater than Title 24 requirements.
- B. Pipe Insulation
  1. Manufacturers: Johns Manville Corporation or approved equal.

2. Glass Fiber: Johns Manville Micro-Lok meeting ASTM C547; rigid molded, non-combustible.
  - a. 'K' (ksi) Value: 0.23 at 75°F (0.033 at 24°C).
  - b. Maximum service temperature: 850°F (454°C).
  - c. Vapor Retarder Jacket: AP-T Plus white kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP jacket with outward cinch expanding staples or vapor barrier mastic as needed.
  
3. Elastomeric Foam: Rubatex R-180-FS/R-1800-FS meeting ASTM C534; flexible, cellular elastomeric, molded or sheet.
  - a. 'K' (ksi) Value: 0.28 at 75°F (0.04 at 24°C).
  - b. Maximum Service Temperature: 220°F (104°C).
  - c. Maximum Flame Spread: 25.
  - d. Maximum Smoke Developed: 50 (for 3/4" thick and below); 100 (for above 3/4" thick).
  - e. Connection: Water vapor retarder adhesive as needed; Rubatex R-373 adhesive.
  - f. UV-Protection: Outdoor protective coating; Rubatex 374 coating.
  
4. Field Applied Jackets:
  - a. PVC Plastic: Johns Manville Zeston 2000. One piece of molded type fitting covers and jacketing material, gloss white.
    - 1) Connections: Tacks; Pressure sensitive color matching vinyl tape.
  - b. Canvas Jacket: UL listed fabric, 6 oz./ sq. yd. (220 g/sq m), plain weave cotton treated with dilute fire retardant lagging adhesive.
  - c. Aluminum Jacket: 0.016 inch (0.045 mm) thick sheet, (smooth/embossed) finish with longitudinal slip joints and 2 inch (50 mm) laps, die shaped fitting covers with zz factory attached protective liner.
  - d. Stainless Steel Jacket: Type 304 stainless steel, 0.010 inch (0.25 mm), (smooth/corrugated) finish.

C. Equipment Insulation:

1. Manufacturers: Johns Manville Corporation or approved equal.
2. Flexible Fiber Glass Blanket: Manville 812 Spin-Glass meeting ASTM C612; flexible.

- a. 'K' (ksi) Value: 0.24 at 75°F (0.035 at 24°C).
  - b. Maximum Service Temperature: 450°F (232°C).
  - c. Density: 1.5 lb./cu. ft. (24 kg/cu m) density.
  - d. Vapor Retarder Jacket: Aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinch expanding staples and vapor barrier mastic as needed.
3. Rigid Fiberglass Board: Manville 814 Spin-Glas meeting ASTM C612; rigid, noncombustible.
- a. 'K' (ksi) Value: 0.23 at 75°F (0.033 at 24°C).
  - b. Maximum Service Temperature: 850°F (454°C).
  - c. Density: 3.0 lb./cu. ft. (48 kg/cu. m)
  - d. Vapor Retarder Jacket: Aluminum foil reinforced with fiber glass yarn and laminated to fire resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinch expanding staples and vapor barrier mastic as needed.
  - e. Facing: 1 inch (25 mm) galvanized hexagonal wire mesh stitched on one face of insulation. (Optional)
4. Rigid Fiber Glass Board: Manville 1000 Spin-Glas meeting ASTM C612; rigid, noncombustible.
- a. 'K' (ksi) Value: 0.23 at 75°F. (0.033 at 24°C).
  - b. Maximum Service Temperature: 850°F (454°C).
  - c. Density: 3.0 lb/cu ft (48 kg/cu m)
  - d. Facing: 1 inch (25 mm) galvanized hexagonal wire mesh stitched on one face of insulation. (Optional)
5. Cellular Glas: ASTM C552; 'K' Value of 0.35 at 75°F (0.047 at 24°C); 8.0 lb./cu. ft. (128 kg/cu m) density.
6. Elastomeric Foam: Rubatex R-180-FS/R-1800-FS meeting ASTM C534; flexible, cellular elastomeric, molded or sheet.
- a. 'K' (ksi) Value: 0.28 at 75°F (0.04 at 24°C).
  - b. Maximum Service Temperature: 220°F (104°C).
  - c. Maximum Flame Spread: 25.

- d. Maximum Smoke Developed: 50 (for 3/4" thick and below); 100 (for above 3/4" thick).
  - e. Connection: Water vapor retarder adhesive as needed; Rubatex R-373 adhesive.
  - f. UV-Protection: Outdoor protective coating; Rubatex 374 coating.
7. Apply insulation as close as possible to equipment by grooving, scoring and beveling insulation, if necessary. As required, secure insulation to equipment with studs, pins, clips, adhesive, wires or bands.
  8. Fill joints, cracks, seams and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.
  9. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.
  10. For insulated equipment contained fluids above ambient temperature, provide jacket with or without vapor barrier.
  11. Cover insulation with metal mesh and finish with heavy coat of insulating cement, mastic or aluminum jacket as indicated in the drawings.
  12. For equipment in mechanical equipment rooms or in finished spaces, finish with Manville Zeston 2000 jacketing and fitting covers or aluminum jacketing.
  13. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.
  14. When equipment with insulation requires periodic opening for maintenance, repair or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

D. Piping Insulation Schedule:

1. Insulate waste lines receiving cold condensate same as roof drainage to first branch receiving waste.

Description	Pipe Size Inch	Thickness Inch
1. Flexible Fiber Glass Insulation	up to 2 inch	1
Domestic Hot 70°F to 200°F	2 inch to 4 inch	1-1/2
Cold Water	all sizes	1
2. Elastomeric Foam		
Domestic Hot 70°F to 200°F	up to 2 inch	1

2.6 FIXTURES (See Plumbing drawing for complete plumbing fixture specifications)



- A. Accessible plumbing fixtures shall comply with all of the requirements of CBC Section 1115B. Heights and location of all fixtures shall be according to CBC Table 1115B-1. Fixture controls shall comply with CBC Section 1118B.
- B. Plumbing fixtures shall be by the manufacturers listed below. Make type and Model Number for fixtures are shown on drawing schedules.
  - 1. For water closets, urinals, lavatories, and service sinks – Sloan, American Standard, Kohler or Crane.
    - a. Water closet and urinal flush valves – Sloan or Delany.
    - b. Lavatory faucets – Elkay, American Standard, Kohler, Crane, Sloan or Delany.
    - c. Service sink faucet – American Standard, Kohler or Crane.
    - d. Toilet seats – Church, Olsonite or Beneke
  - 2. Stainless Steel Sinks – Elkay or Just
    - a. Sink Faucet – Elkay or Just
  - 3. Drinking Foundation – Elkay, Haws, Sunroc or Halsey – Taylor.
  - 4. Emergency Eyewash and Showers – Guardian or Acorn.
  - 5. Floor Drain, Floor Sinks, Roof Drains, Overflow Drains, Roof Receptor and Air Gap Fittings – J.R. Smith, Josam or Zurn.
  - 6. Hose Bibbs – Acorn, Woodford.
  - 7. Trap primers – Precision Plumbing Products or approved equal.
- C. Water Heater (See Schedule on Drawing)
  - 1. Manufacturer based upon A.O. Smith or approved equal.
  - 2. Tankless Type with Circulating Pump.
- D. Expansion Tank (See Schedule on Drawing)
  - 1. Manufacturer based upon Amtrol model Therm-X-Trol. Equal products by HG Spec may be submitted for approval.
  - 2. Provide factory pre-charged steel tank with ASME label and internal butyl diaphragm to isolate air and water.
- E. Gas-Fired Steam Pressure Washer (See Schedule on Drawing)
  - 1. Manufacturer based upon Alkota Model 241-NG or approved equal.

2. Tankless Type with Circulating Pump
- F. Heavy Duty Hose Reel (See Schedule on Drawing)
1. Manufacturer based upon Lincoln Industrial or approved equal.
- G. Air Compressor and Refrigerated Air Dryer (See Schedule on Drawing)
1. Manufacturer based upon Champion or approved equal
- H. Sand-Oil Interceptor:
1. The Sand-Oil Interceptor shall have two compartments.
  2. The Sand-Oil Interceptor shall have minimum (2) 24" diameter access openings. One opening over the inlet and the other opening over the outlets.
  3. The Sand-Oil Interceptor shall be precast concrete with a minimum compressive strength of 4,000 psi at 28 days.
  4. The Sand-Oil Interceptor shall be capable of supporting H-20 traffic loading, without the additional of traffic slab, provided that a minimum of 12" earth cover is maintained above the tank.
  5. All standard Sand-Oil Interceptor shall be listed with the International Association of Plumbing and Mechanical Officials (IAPMO) and City of Alhambra.
  6. The Sand-Oil Interceptor shall be placed on level undisturbed soil or on an approved compacted fill.
  7. Manufacturer by Jensen or equal.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

A. General:

1. Inspect the architectural, structural, fire protection, special system and HVAC drawings and specifications to become familiar with the type of building construction and to coordinate with the work of others.
2. Apparatus, fixtures, devices and appliances which require pipe connections shall be so equipped and each such pipe connection shall be valved or trapped, or provided with special apparatus as indicated on the drawings or elsewhere specified. Where such connections are not indicated on the drawings or specified they shall be made in the usual manner recommended by the manufacturer of each such equipment.

B. Piping:

1. Install in a manner that permits expansion and contraction caused by changes in water temperature and pressure. Provide additional supports as required. Run pipes straight and true, parallel to or at right angles to the building walls. Springing or forcing piping into place will not be permitted.
2. Reduced fittings shall be used in lieu of bushings. Close nipples will not be permitted.
3. Pipe lines shall be installed in the locations and of the sizes shown on the drawings or specified herein and of the material and workmanship herein specified and shall be free from stain, tool, marks or other foreign substances.
4. Exposed piping in the building shall be installed parallel to or at right angles to the building walls. Pipe lines shall be installed free from traps and air pockets and true to line and grade. Horizontal lines shall be installed as close to the building construction as possible so as to leave the greatest possible head room under them.
5. The only filler that may be used in making up screw joints in pipe lines shall be an approved graphite paste or Teflon tape.
6. Copper tube water lines shall be fitted with drop ear elbows securely anchored to the building framing at each fixture supply stub-out.
7. Where pipes of two dissimilar metals are joined, "Mallory" dielectric couplings or approved equal shall be installed.
8. Saw cut or core drill existing slabs or walls to install pipes, equipment or fixtures.
9. Where valves are not accessible from utility or furred spaces, the Contractor shall furnish and install "Access Panels."
10. Where screw and valves are used in threaded pipe lines there shall be a union installed in the pipe as close to the valve as possible. At soldered pipe lines an I.P.S. to copper adaptor shall be installed on both sides of valve screw end.
11. Valves of pipe lines of each service shall be tagged with the valve discs or nameplates as specified hereinafter, except where the use is obvious or where the apparatus controlled is visible from the valve.
12. Valves other than relief valves and air vent valves shall be the same size as the pipe lines in which they are installed. Valves shall be packed with an approved brand or graphited valve stem packing.

C. Fixtures and Equipment:

1. Install in strict accordance with manufacturer's written installation instructions and recommendations. Fixtures shall be roughed in only from fixture manufacturer's certified "Rough-In" Measurement Drawings, which shall be submitted to the [Architect] [Engineer] for approval.

D. Water Hammer Arrestors: Install at end of fixture headers with two or more fixtures or at each fixture, which may create surges during normal operation. Install in the upright position as close

as possible to valve or valves being served. Provide 12" x 12" brushed stainless steel access door with locking cover.

- E. Backflow protection devices of code approved type and shall be provided and installed where required by code.

### 3.2 INSULATION

- A. Verify that surfaces are clean, dry and free of foreign material.
- B. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- C. Continue insulation vapor barrier through penetrations except where prohibited by code.

#### D. Piping Insulation:

1. Locate insulation and cover seams in least visible locations.
2. Neatly finish insulation at supports, protrusions and interruptions.
3. Provide insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.
4. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges and unions.
5. Provide insert between support shield and piping on piping 1-1/2 inches (38 mm) diameter or larger. Fabricate heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths:

1-1/2" to 2-1/2" pipe size	10" long
3" to 6" pipe size	12" long
8" to 10" pipe size	16" long
12" and over	22" long

6. For pipe exposed in mechanical equipment rooms or in finished spaces below 10 feet (3 meters) above finished floor, finish with aluminum jacket.
7. For exterior applications, provide weather protection jacket or coating. Insulated pipe, fittings, joints and valves shall be covered with [PVC] or [aluminum] jacket. Jacket seams shall be located on bottom side of horizontal piping.

### 3.3 SEISMIC REQUIREMENTS

- A. Equipment and piping shall be provided with seismic restraint devices to limit movement. See Section 15010 and provide in accordance with SMACNA "Seismic Restraint Manual" guidelines for Mechanical Systems.

### 3.4 PIPE CLEANING AND DISINFECTION FOR POTABLE WATER PIPING

- A. Pipe cleaning and disinfection applied to hot and cold potable water systems and shall be performed after pipes, valves, fixtures, and other components of the systems are installed, tested and ready for operation.
- B. Potable water piping shall be thoroughly flushed with clean potable water prior to disinfection to remove dirt and other contaminants. Screens to faucets shall be removed before flushing and reinstalled after completion of disinfection.
- C. Disinfection shall be done using either chlorine gas or liquid chlorine. Calcium or sodium hypochlorite may be used as approved in AWWA C601 procedures.
- D. A service cock shall be provided and located at the water service entrance. The disinfecting agent shall be injected into the system from this cock only.
- E. The disinfecting agent shall be injected by a proportioning pump or device through the service cock slowly and continuously at an even rate. During disinfection, backflow of disinfecting agent into main water supply is not permitted.
- F. Sectional valves must be operated during disinfection. Outlets must be fully opened at least twice during injection and the residual checked with orthotolin solution.
- G. When the chlorine residual concentration, calculated on the volume of water the piping will contain, indicated not less than 50 Parts Per Million (PPM) at outlets, then valves must be closed and secured.
- H. The residual chlorine shall be retained in the piping systems for a period of not less than 24 hours.
- I. After the retention, the residual shall be not less than 5 PPM. If less, then the process shall be repeated as described above.
- J. If satisfactory, then fixtures shall be flushed with clean potable water until residual chlorine by ortholine tests shall be not greater than the incoming water supply (this may be zero).
- K. Work and certification of performance shall be performed by approved applicators or qualified personnel with chemical and laboratory experience.
  - 1. Certification of performance shall indicate:
    - a. Name and location of the job and date when disinfection was performed.
    - b. Material used for disinfection.
    - c. Retention period of disinfectant in piping system.
    - d. PPM chlorine during retention.
    - e. PPM chlorine after flushing.

- f. Statement that disinfection was performed as specified.
  - g. Signature and address of company/person performing disinfection.
- L. Upon completion of final flushing (after retention period), the Contractor shall obtain one water sample from hot water system and one from the cold water system and submit samples to a State approved laboratory. Results from laboratory shall be provided to [Architect] [Engineer] and shall indicate:
- 1. Name and address of approved laboratory testing the samples.
  - 2. Name and location of job and date the samples were obtained.
  - 3. The coliform organism count. An acceptable test shall show absence of coliform organisms.
- M. If analysis does not satisfy the above minimum requirements, the disinfection procedure must be repeated.
- N. Before acceptance of the systems, the Contractor shall submit to the [Architect] [Engineer] for his review, three copies of Laboratory Report and three
- O. Under no circumstances shall the Contractor permit the use of potable water systems until properly disinfected, flushed and certified.

### 3.5 TESTS

- A. Drainage piping shall be tested and proved tight under 10 feet of water pressure prior to replacing ceilings.
- B. Water piping and pumped drain or forced main piping shall be purged of air and tested and proved tight under 125 PSI hydrostatic pressure for a period of not less than two hours.
- C. Gas piping shall be tested with air and proved tight under 60 psi for a period of not less than two hours.
- D. Compressed air piping shall be tested with air and proved tight under 150 psi for a period of not less than two hours.
- E. Automobile Service Piping:

SYSTEM TESTED	GAUGE PRESSURE AT START OF THE TEST (PSIG)	TEST WITH
MOTOR OIL SYSTEMS	150	OIL
INDUSTRIAL COLD WATER	125	WATER

- F. Repair all leaks and repeat the test as specified.

### 3.6 CLEANING

- A. Equipment, piping, etc., shall be thoroughly cleaned so as to remove rust, scale, plaster, or internal obstructions before a covering is installed or piping or equipment is painted. no scarring or disfiguring of equipment, piping, etc. will be acceptable before covering or painting is applied.
- B. Parts of the work which are to be painted or which are exposed in the finished work shall be thoroughly cleaned and made ready to receive paint finish.
- C. The exposed parts of equipment shall be cleaned, oil and grease removed, and the bright parts left clean and polished.
- D. Upon completion of the work, remove rubbish, debris and surplus materials, resulting there from, the premises together with his instruments, and equipment and shall leave the site in a neat, clean and acceptable condition as approved by the Architect.

### 3.7 PRELIMINARY OPERATIONS

- A. Should the Owner require that a portion of the systems or equipment be operated prior to the final completion and acceptance of the work, the Contractor shall furnish such operation. The expense thereof will be paid by the Owner, separate and distinct from money paid on account of the contract.
- B. Such preliminary operation or testing, payment shall not be construed as final acceptance of the work of this contract.

### 3.8 EXCAVATION AND BACKFILL

- A. Comply with the requirements for trenching, backfilling and compaction as specified in Division 2.

END OF SECTION

**SECTION 23 05 00  
COMMON WORK RESULTS FOR MECHANICAL**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Requirements of Divisions 0 and 1 apply to work of this section.

1.2 RELATED SECTIONS

- A. This section applies to all sections of Division 23, except as may be otherwise modified in each section.

1.3 FEES, PERMITS AND PAYMENTS

- A. Fees, Permits and Payments: Contractor shall secure all permits and inspections and pay full cost of same.

1.4 RELATED WORK SPECIFIED ELSEWHERE

- A. Work designated on drawing or specifications to be installed or performed by other sections of the inspections.
- B. Concrete
- C. Access Doors
- D. Finish painting: Equipment furnished shall be factory finished. If the factory finish is damaged during shipment, installation, etc., it shall be repainted by the Contractor subject to the Architect's approval.
- E. Louvers not connected to sheet metal plenums or ductwork.
- F. Electrical connections for motors, line voltage wiring and conduit and low voltage wiring and conduit.
- G. Individual motor controllers except when furnished as integral parts of packaged equipment.
- H. Motor Control Centers.
- I. Landscape Irrigation System.
- J. Water, sanitary and site storm piping.

1.5 EQUIPMENT RESTRICTIONS

- A. The proprietary name, and/or model indicated on the drawings, or the first listed for any category in the specifications is the make and/or model used as the basis for design. All bids shall be based on the use of the products of the selected manufacturers.



Substitutions will be considered as outlined in General Conditions and Division 1; Section, "Substitutions." Other acceptable manufacturers are named in these specifications.

- B. Choice of Equipment: Equipment has been chosen, which will properly fit into the physical spaces provided and indicated, allowing ample room for access, serving, removal and replacement of parts, etc. Adequate space shall be allowed for clearance in accordance with the code requirements and the requirements of the local inspection Department. Physical dimensions and arrangements of equipment to be installed shall be subject to the Owner's approval. Submit shop drawings of equipment layout for approval where equipment space does not comply with drawings. Any changes in piping, motors, wiring, controls, structural or installation procedures required by the substituted product or equipment shall be made at no additional cost to the Owner, and with no reduction in scope.
- C. Space Requirements:
  - 1. In the preparation of drawings, a reasonable effort has been made to include all equipment manufacturers' recommendations. Since space requirements and equipment arrangement vary according to manufacturer, the responsibility for initial access and proper fit rests with the Contractor. The final arrangement of the equipment and service connections shall allow the unit to be serviced. This shall include space to pull motors, filters, coils, tubes, etc. Make changes in piping and ductwork to suit actual installed equipment without further instructions or additional cost.
  - 2. If the installation of the particular product or equipment, the Contractor has submitted, requires changes in material or size from that required in the contract drawings and specifications, such changes shall be submitted as shop drawings.
  - 3. Contractor shall be aware that some equipment in the mechanical room must be in place before walls and/or roof is installed and shall schedule the installation of equipment accordingly.
  - 4. Contractor shall pay the costs of design (3.0 x direct payroll) and installation of changes resulting from substitution of alternate products. Acceptance of alternate products by Architect does not change this requirement.

## 1.6 QUALITY ASSURANCE

- A. Installer's Qualifications:
  - 1. For the actual fabrication, installation and testing of work under this section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturers' current recommended methods of installation.
  - 2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of the installers.
- B. Certificates: Execute on behalf of the Owner and deliver to the Architect all manufacturers' warranty certificates and instructions, etc. required to assure that the

manufacturers' warranties are properly documented and in full effect for the warranty period.

## 1.7 CODES, ORDINANCES, REGULATIONS AND DEFINITIONS

- A. Reference to technical societies, trade organizations, governmental agencies are made in Mechanical Sections in accordance with the following abbreviations:
- B. All work and materials shall be in full accordance with the latest rules and regulations of the following Agencies and Codes Division of the State Architect the Safety Orders of the Division of Industrial Safety; 2019 California Mechanical Code; 2019 California Plumbing Code; 2019 California Building Code; 2019 Title 24 State Code of Regulations; city ordinances and other applicable laws or regulations.

Nothing in the drawings or specifications is to be constructed to permit work not conforming to these codes. Drawings and specifications shall take precedence when work and materials called for exceed code requirements.

- C. References to Code Specifications shall mean editions in effect at date of proposals.
- D. Reference to technical societies, trade organizations, governmental agencies are made in Mechanical Sections in accordance with the following abbreviations:

AABC	<i>Associated Air Balance Council National Standards for Field Measurement and Instrumentation, Total System Balance</i>
AGA	<i>American Gas Association</i>
AMCA	<i>Air Moving and Conditioning Association</i>
ANSI	<i>American National Standards Institute</i>
ARI	<i>Air Conditioning and Refrigeration Institute</i>
ASHRAE	<i>American Society of Heating, Refrigerating, and Air Conditioning Engineers</i>
ASTM	<i>American Society of Testing and Materials</i>
AWWA	<i>American Water Works Association</i>
CCR	<i>California Code of Regulations</i>
CISPI	<i>Cast Iron Soil Pipe Institute</i>
DSA	<i>Division of the State Architect</i>
ETL	<i>Electrical Testing Laboratory</i>
FM	<i>Factory Mutual</i>
IRI	<i>Industrial Risk Insurers</i>
ISO	<i>Insurance Service Organization</i>
NEBB	<i>National Environmental Balancing Bureau Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems</i>
NEC	<i>National Electrical Code</i>
NFC	<i>National Fire Codes</i>
NFPA	<i>National Fire Protection Association</i>
NRCA	<i>National Roofing Contractor's Association</i>
OSHA	<i>Occupational Safety and Health Administration</i>
PDI	<i>Plumbing and Drainage Institute</i>
SMACNA	<i>Sheet Metal and Air Conditioning</i>
UL	<i>Underwriter's Laboratories, Inc.</i>

- E. Fees, Permits, Licenses and Payments: Contractor shall secure all permits and inspections and pay full cost of same.

F. Definitions:

APPROVED	<i>As approved by Owner's Representative.</i>
ARCHITECT / ENGINEER	<i>The Architect or Engineer of record for this project. The Architect or Engineer is the Owner's representative regarding preparation, revisions and interpretation of the contract documents.</i>
AS DIRECT	<i>As directed by the Owner's Representative.</i>
AS REQUIRED	<i>As required by applicable Code requirements; by good business practice; by the conditions prevailing; by the Contract Documents; by Owner, or by Owner's Representative.</i>
AS SELECTED	<i>As selected by Owner's Representative.</i>
BATTERY	<i>A "battery" of fixtures is two or more fixtures served from same branch.</i>
BY OTHERS	<i>Work on this Project that is outside the Scope of Work to be performed by the Contractor under this Contract, but that will be performed by Owner, other Contractors or other means.</i>
CERTIFIED TEST REPORTS	<i>Test Reports signed by an authorized official stating that tests were performed in accordance with the test method specified that the results reported are accurate, and that items tested either meet or fail to meet the stated minimum requirements. These Test Reports include those performed by Factory Mutual, Underwriters Laboratories, Inc., and others.</i>
CERTIFIED INSPECTION REPORTS	<i>Reports signed by approved Inspectors attesting that the items inspected meet the Specification requirements other than any exceptions included in the report.</i>
CONCEALED	<i>Means embedded in masonry, concrete or other construction, installed within furred spaces, or in enclosures.</i>
EQUAL	<i>The Contract documents are based upon the manufacturer and model number indicated on the drawings or specifications. Bidder may propose alternative product but will be considered only if the bidder has submitted a</i>

*base Bid, which is in accordance with the specified product. Alternate proposal shall include complete technical data and itemized price adjustments. Bidder shall assume the responsibility that the alternate product meets the physical, mechanical, electrical, structural, acoustical and architectural requirements of the specified product. Acceptance of an alternate product does not entitle the Contractor to a Change Order to modify architectural, structural, mechanical, electrical, control or any other systems necessary to accommodate the alternate product. The Owner or his representative may reject any or all-alternate products.*

EXPOSED	<i>Means not installed underground or not concealed as defined above.</i>
FIELD TESTS	<i>Tests or analysis made at, or in the vicinity of the job site in connection with the actual construction.</i>
FURNISH	<i>Supply and deliver to the Project site only, not install (unless required to be installed elsewhere in the Contract Documents). Product must be delivered ready for installation and in operable condition.</i>
INSTALL	<i>Install (services or labor) only, not furnish (unless required to be furnished elsewhere in the Contract Documents). Install means to place in final position, complete, anchored, connected and ready to operate.</i>
MAIN	<i>A "main" of any system of continuous piping is the principal artery of the system, to which branches may be connected.</i>
MANUFACTURER'S DIRECTIONS, INSTRUCTIONS, RECOMMENDATIONS, SPECIFICATIONS	<i>Manufacturer's written directions, instructions, recommendations, specifications.</i>
PRODUCT	<i>Means all materials, systems, equipment and fixtures.</i>
MANUFACTURER'S CERTIFICATE CONFORMANCE	<i>A certificate signed by an authorized manufacturer's official attesting that the material or equipment delivered meets the specification requirements. Manufacturer's representative certificate is not acceptable.</i>

MUST; SHALL; TO; WILL	<i>When used as a directive to the Contractor, these items indicate a mandatory action.</i>
NECESSARY	<i>Essential to completion of work.</i>
OWNER-FURNISHED, CONTRACTOR-INSTALLED PROVIDE	<i>To be furnished by the Owner at its cost and installed by the Contractor as part of the work. Shall include "Furnish and install" which means supply, fabricate, deliver, place and connect, complete in place, ready for operational use. When neither furnish, install or provide is stated, "provide" is implied.</i>
REMOVE	<i>Means to remove item completely including attachments, frames, anchors, fittings, bases, pipes, conduits and supports, capping behind finished surfaces and repairing floors, bases and walls to match color and texture and be smooth with existing adjacent surfaces.</i>
RISER	<i>A "riser" is vertical waterline supplying two or more fixtures, or batteries of fixtures located in different rooms.</i>
SHOWN	<i>As indicated on the Drawings.</i>
SPECIFIED	<i>As written in the Contract Documents.</i>
SUBMIT	<i>Submit to Owner's Representative.</i>
TESTING LABORATORY	<i>The term "testing laboratory" means any person or organization whose functions include testing, analyzing or inspecting products and/or evaluating the designs or specifications of such products according to the requirements of applicable standards.</i>
WORK	<i>Work of the Contractor or Subcontractor includes labor or materials (including, without limitation, without equipment and appliance) or both, incorporated in, or to be incorporated in the construction covered by the complete Contract.</i>

1.8 SUBMITTALS

- A. General: Refer to Division 1.
- B. Project Drawings:
  - 1. The drawings are diagrammatic and indicate the general layout of the equipment.

2. The exact location shall be field determined, after shop drawing review for the installation in available space at the job site.
- C. Equipment Lists and Equipment Brochures and Shop Drawings.
1. Copies: Submit six (6) copies of data as specified hereafter.
  2. All items of material and equipment required by this Division shall be reviewed by the Architect prior to the start of any work. The Contractor shall submit all items requiring such review, allowing ample time for the checking and processing, and shall assume all responsibility for delays incurred due to the rejected items. All rejected items shall be resubmitted as specified only. Submittal information covering all items shall be neatly bound together into booklets, each booklet containing all individual items specified. Separate submittals of individual items are not allowed. Each submittal item shall be identified with the governing specification section, paragraph, subparagraph, or reference drawings, as applicable.
  3. Equipment Lists: Provide name of manufacturer, brand name, and catalog number of each item. Submit complete submittals, at one time, having items arranged in numerical sequence with each item identified by section and article of the specifications. Listing items "as specified" without both name and model or type designation is not acceptable, except pipe and fitting not specified by brand names may be listed "as specified" without manufacturer's name, provided proposed materials comply with specification requirements.
  4. Material Brochures: Provide copies of complete description, information and performance data covering materials and equipment, which are specified. Brochures submitted to the Architect shall be published by the manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures not compiled in the following manner shall be returned for re-submittal. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs, which describe several different items other than those items to be used unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified.
  5. Shop Drawings: Refer to Divisions 0 and 1. Provide additional data as specified in Governing Specification Section.
  6. Miscellaneous: Prior to installation, submit to Construction Supervisor on the job site, two copies of the following:
    - a. Shop Drawings of equipment layouts.
    - b. Installation instructions for each piece of mechanical equipment furnished.
    - c. Dimension drawings for all mechanical equipment pads and curbs including bolt sizes and locations.
  7. All submittals required by these specifications, include drawings, calculations, brochures, samples, etc. shall be submitted as one package. Partial submittals will be returned unprocessed.

D. Record Drawings and Operating and Maintenance Books

1. Record Drawings (Refer to Division 1): On completion of work, furnish the Owner through the Architect, with a complete set electronic record drawings and shop drawings which properly reflect the locations of all equipment, fixtures, piping, ductwork, diffusers, mixing boxes, controls, etc., as actually installed. Where necessary to locate concealed equipment, dimensions, shall be included on these drawings. Maintain a separate set of drawing prints at the job site for such marking of "As-Built" locations. This set shall be updated as the installation work progresses and shall be available to the Architect at job visits. The Contractor shall indicate on the "As-Built" Drawings all deletions in green. All additions, relocations, rerouting and modifications shall be indicated in red.
2. The format shall be AutoCad or Revit release 2018 or later. A diskette or USB drive with the electronic model will be supplied to the successful bidder for this purpose. Monthly changes shall be made to the drawings on a layer named "record" and the color shall be green. A copy of the model on diskette with any "as-built" changes shall be submitted to the Architect along with all payment applications.
3. At the end of the project, the Contractor shall take "as-built" drawings modifying the electronic drawing files to show all changes, modification or additions made during construction. These drawings will become "Record Drawings" to be delivered to the Architect.
4. Final Record Drawings shall include legends, schedules, plans, sections and details.
5. All Record Drawings shall be marked on the lower right corner with the following:
  - a. Name of Contractor
  - b. Record Drawings
  - c. Date
  - d. Building Permit Number

Letter shall be bold and print 1/4 inches high minimum.

6. Contractor shall submit to the Architect, Record Drawings as follows:
  - a. Four USB Drives (AutoCad or Revit 2018 or later)
  - b. Four (4) hard copy prints

7. The Architect will distribute the final Record Drawings as follows:

	OWNER	ARCHITECT	ENGINEER
USB Drive	1	1	1
Prints	1	1	1

8. Delivery of complete set of Record Drawings is one condition for the release of Contractor's final payment under the Contract.

E. Operating and Maintenance Books

1. Operating and Maintenance Books (Refer to Division 1): Provide the Owner through the Architect, operating instructions and maintenance data books for all equipment and materials furnished under this Division.
2. Submit five (5) copies of operating and maintenance data books to the Architect for review two weeks before final inspection of the project. Assemble all data in a single complete indexed volume and identify the size, model and features indicated for each item, as follows:
  - a. Identification readable from the outside of the cover, stating "Heating, Ventilating and Air Conditioning and/or Plumbing and/or Fire Protection Installation. Owner, by (name of company)."
  - b. Neatly typewritten index near the front of the manual, furnishing immediate information as to location in the manual of all emergency data regarding the installation.
  - c. Complete instructions regarding the operation and maintenance of all equipment involved.
  - d. Complete nomenclature of all replaceable parts, their part numbers, current cost and name and address of the nearest vendor of replacement parts.
  - e. Valve identification table keyed to valve I.D. number (e.g. V-1) on brass tag attached to each valve. Table shall indicate type of valve, product or service (e.g. domestic cold water), and function (e.g. shut-off, balancing, etc.).
  - f. Copy of all guarantees and warranties issued on the installation showing all dates of expiration.
  - g. Copy of the Air and Water Balancing Reports.

#### 1.9 EXPLANATION AND PRECEDENCE OF DRAWINGS

- A. For purpose of clearness and legibility, the drawings are essentially diagrammatic although size and location of equipment is drawn to scale wherever possible. The Contractor shall make use of all data in all contract documents and shall verify this information at building site.
- B. Attention is called to the inclusion of flow diagrams, riser diagrams and details. Diagrams are not for the purpose of giving physical dimensions or locations, but rather to clarify sizes and the interconnections of the piping and of the various units of the process.
- C. All other drawings of the contract set are hereby made a part of these specifications and shall be consulted by the Contractor and his work adjusted to meet the installation conditions.
- D. Drawings indicate required size and termination of pipes and ducts and suggest proper routes of piping and duct to conform to the structure, to avoid obstructions and to preserve clearance. However, it is not the intention to indicate all necessary offsets and it shall be the responsibility of the Contractor, under this section, to install ductwork and piping in such a manner as to conform to structure, avoid obstructions, preserve headroom, keeping openings and passageways clear, and make all equipment requiring inspection, maintenance and repair accessible without further instructions or extra cost to the Owner.



- E. Changes in location on all piping, apparatus and equipment as indicated on the drawings shall be made to meet the architectural and structural conditions as required and acceptable to the Architect. Any change in work which has not been installed shall be made by Contractor without additional compensation, except changes which are caused by architectural and structural changes which increase the lengths of pipe or duct runs.
- F. Contractor shall coordinate with all other trades so that no interferences shall occur, as no extras will be allowed for changes made necessary by interferences with the work between trades.
- G. CAD or Revit files plots and reproductions for this project are the property and instruments of service of dHA+CALPEC. dHA+CALPEC reserves and retains all copyright authority, privileges and rights.
  - 1. Upon request and subject to some limitations dHA+CALPEC with their client's approval, may allow contractors and/or vendors to acquire and use copies of the electronic media file data for preparation of:
    - a. Fabrication of shop drawings for this project.
    - b. Submittals pertaining to this project.
    - c. Record documents.
  - 2. Applicable limitations include:
    - a. The Contractor or vendor acquiring these files agrees to hold harmless dHA+CALPEC, the Architect and Owner from all liability and/or damages resulting from their use.
    - b. The Contractor or vendor acquiring these data files assumes full responsibility for their use and for the correctness of any information or features contained therein.
    - c. dHA+CALPEC does not warranty, (explicit or implied) the accuracy of the building backgrounds, or any dimensions or features contained therein.
    - d. Usage is limited to this specific project and the specific acquirer.
    - e. The files are released solely for the convenience of the contractor or vendor acquiring same and CAD files may not be transferred to third parties without written prior approval.
    - f. dHA+CALPEC shall remove all seals, proprietary identification, etc.

#### 1.10 COMPLETE PERFORMANCE OF WORK

- A. Practices of the Trades: Work shall be executed in strict accordance with the best practice of the trades by competent workmen.
- B. Complete Functioning of Work: All labor, materials, apparatus, and appliances essential to the complete functioning of the systems described and/or indicated, or which may be reasonably implied as essential, whether mentioned in these contract documents or not, shall be furnished and installed by the Contractor. In cases of doubt as to the work intended, or in the event of need for explanation thereof, the Contractor shall call upon the Architect for supplemental instructions.
- C. All work not shown in complete details shall be installed in conformance with accepted standard practice.

#### 1.11 CONTROL AND OBSERVATION

- A. The Architect and Owner shall have the right to reject materials or workmanship, which in their opinion are not in accordance with this contract, to interpret contract provisions and the meaning of the drawings and specifications. The above-named parties shall be allowed access to the work for observation at all times.
- B. Defective work or work in any way contrary to the contract documents may be rejected without regard to state of completion, even though said work has been accepted as a result of a previous observation.

#### 1.12 APPROVALS

- A. All electrical equipment shall meet the listing requirements and bear a minimum of one of the following agency labels:
  - 1. Underwriter's Laboratories (UL)
  - 2. Electrical Testing Laboratories (ETL)
- B. No equipment will be accepted on the jobsite without prior written approval.

#### 1.13 GUARANTEES

- A. In addition to any specific guarantee mentioned in these specifications, the Contractor shall leave the entire installation in complete working order and free from any and all defects in materials, workmanship or finish. Contractor shall repair or replace at his own expense any part that may develop defects due to faulty material or workmanship during the tests and within a period of one (1) year after the work is accepted by the Owner. Contractor shall guarantee also to repair or replace with like materials any existing work of the building or equipment, which is damaged during the repairing of such defective apparatus, materials or workmanship. The signing of the contract for his work covered by these specifications and of which they shall become a part, shall become a written guarantee on the part of the Contractor to carry out the provisions of this section of these specifications.

#### 1.14 DAMAGE BY LEAKS

- A. During the time period from the date of contract until termination date of this guarantee, the Contractor shall be responsible for damages to the ground, walls, roads, building, piping systems, electrical systems, heating, ventilating and air conditioning systems, building equipment, furniture and other building contents caused by leaks in the piping systems or equipment being installed or having been installed by him. All repair work shall be done as directed by, in a manner satisfactory to the Owner at no additional cost to the Owner.

### **PART 2 - PRODUCTS**

#### 2.1 GENERAL

- A. Standard of Quality: Materials and equipment shall be new and in good condition. The commercially standard items of equipment and the specific names mentioned in sections of Division 23 are intended to establish the standards of quality and performance necessary for the proper functioning of the mechanical work.
- B. Variations: Since manufacturing methods vary, reasonable minor equipment variations are expected; however, performance and material requirements are minimum. The Architect retains the right to judge equality of equipment that deviates from the specifications.
- C. Symbols are for identification. Symbols, capacities, sizes, and electrical characteristics are indicated on the drawings. Contractor shall make all necessary provisions for installation of his equipment and for attaching or connecting his work to other trades.

## 2.2 FLASHINGS

- A. Make all pipes and vents passing through roof or outside wall waterproof with flashings and storm collars or counter flashings.
- B. Except as otherwise noted or required, extend vent pipes passing through roof at least 12 inches above finished roofline.
- C. Furnish and install on each pipe passing through the roof a galvanized sheet metal flashing assembly with eight-inch skirt.
- D. All ductwork-penetrating roof or exterior walls shall be flashed and counter flashed with galvanized sheet metal.
- E. Furnish and install on each pipe passing through the roof a six-pound seamless lead flashing assembly with eight-inch skirt. Flashing shall have steel reinforced conical boot and be complete with open top cast iron counter flashing and permaseal waterproofing compound. For sanitary vent, provide a hood with a minimum 2 to 1 free area to vent pipe size.
- F. All ductwork-penetrating roof or exterior walls shall be flashed and counter flashed with galvanized sheet metal.

## 2.3 PIPE SLEEVES

- A. Provide pipe sleeves for all mechanical piping.
- B. Size pipe sleeves to permit placing pipe and specified isolation material for pipes passing through concrete or masonry walls or concrete slabs.
- C. Sleeve for pipes through floor slabs standard weight black steel pipe with top of sleeve projecting 3" above finished floor. For waterproof sleeves, use J.R. Smith Fig. 172 or equivalent by Zurn or Josam.
- D. Sleeves for pipes through walls shall standard weight black steel Schedule 40 pipe with ends flush with wall surfaces.

- E. Seal pipes passing through fire rated walls or floors. Use Dow Corning 3-6548 Silicone RTV Foam in the annular space between pipes and sleeves. Sealant through fire rated walls shall be rated with the same fire rating as the wall.
- F. Insulated pipe shall be insulated in sleeves, caulked and sealed as above. Use type CS-CW inserts as manufactured by Pipe Shields, Inc.
- G. Pipes passing through exterior walls and concrete walls shall be sealed watertight with "Linkseal" as manufactured by Thunderline Corp. Method of installation as recommended by the manufacturer.

2.4 PIPE ISOLATORS AND COVERING PROTECTION

- A. Pipe isolators: Provide each hanger or clamp for uninsulated piping with an isolation material, having metal backing, to isolate sound vibration and electrolysis. Provide Elcen "Isolator or appeared equal." Isolator not required for fire protection automatic sprinkler piping, waste, vent and natural gas piping.

2.5 ELECTRIC MOTORS

- A. All horizontal mounted fan and pump motors (close coupled excepted) shall be of the "Premium" efficiency type. Provide General Electric "Energy Saver," Westinghose" Tee 11", U.S. Motors, "XB", Baldor "Super E", "Lincoln" "Ultimate EI" motors or approved equal unless otherwise specified. Guaranteed minimum full load efficiencies shall be certified in accordance with Institute of Electrical and Electronic Engineers (IEEE) Standard 112 Test Method B, National Electric Manufacturers' Association (NEMA) MG-1-12.53a, and shall meet or exceed the following minimum criteria:

GUARANTEED MINIMUM FULL-LOAD NOMINAL EFFICIENCY						
MOTOR HORSEPOWER	OPEN MOTORS			ENCLOSED MOTORS		
	1,200 rpm	1,800 rpm	3,600 rpm	1,200 rpm	1,800 rpm	3,600 rpm
1	80.0	82.5	--	80.0	82.5	75.5
1.5	84.0	84.0	82.5	85.5	84.0	82.5
2	85.5	84.0	84.0	86.5	84.0	84.0
3	86.5	86.5	84.0	87.5	87.5	85.5
5	87.5	87.5	87.5	87.5	87.5	87.5
7.5	88.5	88.5	87.5	89.5	89.5	88.5
10	90.2	89.5	88.5	89.5	89.5	89.5
15	90.2	91.0	89.5	90.2	91.0	90.2
20	91.0	91.0	90.2	90.2	91.0	90.2
25	91.7	91.7	91.0	91.7	92.4	91.0
30	92.4	92.4	91.0	91.7	92.4	91.0
40	93.0	93.0	91.7	93.0	93.0	91.7
50	93.0	93.0	92.4	93.0	93.0	92.4
60	93.6	93.6	93.0	93.6	93.6	93.0
75	93.6	94.1	93.0	93.6	94.1	93.0
100	94.1	94.1	93.0	94.1	94.5	93.6
125	94.1	94.5	93.6	94.1	94.5	94.5

150	94.5	95.0	93.6	95.0	95.0	94.5
200	94.5	95.0	94.5	95.0	95.0	95.0

- g. 1/2 HP and Larger: 208 Volt 3 phase, 60 Hertz.
  - h. Smaller than 1/2 HP: 115 Volt, 1 phase, 60 Hertz.
- B. General:
- i. All motors shall be started across the line unless otherwise specified. Motors shall be selected with low starting current and shall be designed for continuous duty to provide the running torque and pull-in-torque required to suit the load. Unless otherwise specified, all motors shall be single speed –1750 rpm.
  - j. All motors shall have standard drip-proof enclosure unless otherwise specified.
  - k. All motors exposed to weather shall be of the totally enclosed fan-cooled type.
  - l. All motors shall have at least 1.15 service factor. Motors shall be selected to operate at design conditions without exceeding nameplate ratings without operating using the service factor.
  - m. Motors shall be sealed or field-lubricated in which case the latter shall be provided with grease fittings.
  - n. Pump motors shall be selected to drive the pump through its characteristic curve, from zero to 25% above the design flow, without exceeding rated full load nameplate horsepower. Pump motor nameplate rating shall not be exceeded in pump operation anywhere in the pump curve.
- C. Three-Phase: All three-phase motors 10 horsepower and smaller shall have cast iron or steel housings and shall be of the squirrel cage induction type. All three-phase motors 15 horsepower and larger shall have cast iron housings and shall be of the squirrel cage induction type.
- D. Single Phase: Single phase motors shall be capacitor-start type having internal thermal overload protection and with starting, pull-in and running characteristics to suit the load.
- E. Where motor is an integral part of equipment, motor manufacturer shall be as recommended by the equipment manufacturer. However, all other items shall comply with these specifications.
- F. Nameplate: A motor nameplate shall be securely affixed to each motor and shall clearly indicate the class of insulation and the service factor in addition to the usual electrical data.
- G. Special Requirements: Refer to various sections of this Division for special requirement for specific items of equipment requiring motors.

- H. Submittals: Manufacturer's data for all equipment requiring motors shall be submitted for review. Indicate the motor manufacturer, motor horsepower, voltage, speed, efficiency, special torque requirements, enclosure and other special requirements.

## 2.6 MOTOR CONTROLLERS

- A. Where required: In general, motor controllers for all motors shall be furnished and installed under Division 16 unless indicated or specified otherwise. Any motor controller that is not an integral part of a piece of equipment shall be furnished under this Division and shall be installed in accordance with the following specifications.
- B. General: The motor controller shall be steel mounted. Controllers shall be front wired and all terminals shall be accessible for wiring directly from the front. No slate or ebony asbestos shall be permitted on any size controller from size 00 through size 8. All contacts shall be solid silver cadmium oxide alloy. Bare copper or silver flashed contacts shall not be permitted. Operating coils shall be pressure molded and so designed that if accidentally connected to excessive voltage, they will not expand, bubble or melt. When a coil fails under over-voltage condition, the motor controller shall definitely drop and not freeze the contacts in the "on" position.
- C. Overload Relays: Overload relays shall be furnished for all three phases and shall be of the hand-reset variety so that blocking the reset mechanism in the reset position will not prevent the starter from dropping out if the motor is overloaded. This specifically excludes those overload relays which change to automatic reset from hand-reset when the reset mechanism is blocked unless the automatic reset feature can be removed or voided. Accidental depressing of the reset button or mechanism shall not shut off the motor. Overload relays shall not be field convertible from hand to automatic reset type.
- D. Interlocks: Provide space to field-add one or more extra N.O. or N.C. interlocks to all (except size 00) motor controllers without removing existing wiring or removing the controller from its enclosure.
- E. Bulletin Numbers: Any full voltage magnetic motor controller to be furnished under this Division shall be similar and approved equal to Allen-Bradley (AB) Bulletin Numbers as follows:
  - 1. Individual three phase motor controller – AB Bul. 709.
  - 2. Individual single phase motor controller – AB Bul. 709SP.
  - 3. Combination three phase motor controller with fusible or nonfusible disconnect switch –AB Bul. 712.
  - 4. Combination three motor controller with circuit breaker –AB Bu. 713.
  - 5. Individual three multi-speed motor controller for two speed, single or two winding motors –AB Bul. 716.
  - 6. Combination three phase multi-speed controller with circuit breakers for two speed, single or two winding motors –AB Bul. 717

- F. NEMA Type: In general, motor controller enclosures shall be NEMA Type 1 general purpose unless exposed to the weather or otherwise indicated on the drawings. Any motor controller exposed to the weather shall have NEMA Type 3R watertight enclosure.
- G. Holding Coils: General holding coils in full voltage magnetic motor controllers shall be suitable for use on 120 Volt A.C. control voltage.
- H. Overload Protection: All three-phase full voltage magnetic motor controller shall be suitable for use on 120 Volt A.C. control voltage.
- I. Manual Controllers: Manual motor controllers where indicated on the drawings, required and/or specified shall be similar and equal to Allen Bradley Bul. 600 in NEMA Type 1 enclosure or otherwise required for the location of the installation.
- J. Accessories: Motor controllers shall be provided with accessories such as control power transformers, push buttons, selector switches, pilot lights, etc., as indicated on the drawings and as specified herein. In general, most motor controllers shall include a maintain-contact start-stop button or run switch.
- K. Manufacturer: Allen-Bradley or approved equal.

## 2.7 BELT DRIVES AND GUARDS

- A. Belt Driven Equipment: Provide with V-belt type, adjustable-pitch driving sheaves for up through 25 HP motors. 30 HP and above shall have fixed pitch. Provide additional drive changes for all motors when necessary to meet specified CFM for final air balance (one change minimum) at no additional cost to owner.
- B. Drives: Minimum HP rating of 1.5 times motor nameplate HP.
- C. Sheaves: Cast iron, machined and balanced and keyed to shaft and locked with Allen type set screws.
- D. Pitch Diameters: Minimum 3.0 inches for A section belts, minimum 5.0 inches for B section belts.
- E. Guards: Provide belt drives with guards per OSHA requirements, all metal construction, with angle iron framework with 1/2 inch expanded metal front panels and removable section held in place with studs and wing nuts for easy replacement of belts. Provide openings at shaft ends for tachometer readings.

## 2.8 ESCUTCHEONS

- A. Provide heavy chrome-plated or nickel-plated plates or approved pattern on pipe passing through floors, walls and ceilings in finished areas. Escutcheons shall be chrome-plated steel plates with concealed hinges and setscrew. Pattern shall be approved by the Architect.

## 2.9 CORROSION PROTECTION

- A. Prior to delivery to the job site, wrap buried steel pipe with corrosion protective wrap of pressure sensitive polyvinyl chloride or polyethylene tape applied after pipe has been

thoroughly cleaned. Tape shall be nominal thickness of 20 mils consisting of one layer of 20 mil tape or two separate layers of 10 mil tape. Apply with suitable primer adhesive recommended by manufacturer.

- B. Tightly apply tapes with 1/2 inch minimum uniform lap, free from wrinkles and voids. Use approved wrapping machines and experienced operators.
- C. Tapes: "Chasekote" No. 775, Plicoflex No. 340-25, Polyker 922 and 923, "Scotchwrap" No. 51 or equal. Apply tape after pipe is cleaned as recommended by the tape manufacturer.
- D. Cover filed joints and fittings by wrapping polyethylene or polyvinyl tape specified for wrapping piping, except use two layers of 10 mil thick tape. Wrap joints to provide minimum of six-inches over adjacent pipe covering. Where fittings are wrapped, width of tape shall not exceed two inches. Apply adequate tension so tape will conform tightly to contours of fittings. Use putty tape insulation compounds such as "Scotchfil" or equal to fill voids and provide smooth even surface for application of tape wrap.
- E. Alternate: In lieu of tape wrap, factory applied plastic coating on steel pipe will be acceptable. Use tapes for field joints, fittings and valves same as specified above. Pipe Coating: "X-Tru Coat" (20 mil thick) as manufactured by Standard Pipe Protection, Republic, Pipe Line Service Corp., Scotchkote 202 (12 mil thick) as manufactured by 3M Company, or equal, with "X-Tru-Tape", or equal, for joints and valves.
- F. Test wrapped or coated pipe, fittings and field joints on job site, after assembly, with approved high voltage holiday detector Tinker and Razor, or equal, with positive signaling device to indicate any flaws, holes or breaks in wrapping. Set peak voltage to 10,000 volts. If Scotchkote 202 is used, set peak voltage to 1,000 volts. Place piping on temporary blocks to allow testing to run along underside of pipe. Repair defects before covering. Conduct testing in presence of Architect or his representative.
- G. No special precautions are required for copper or plastic piping below grade.
- H. Special wrapping is required for contact with concrete such as thrust blocks or floor slabs. Piping shall be wrapped with minimum 8 mil thick polyethylene plastic sheets.

## 2.10 ACCESS COVER AND ACCESS DOORS

- A. Provide access covers over under floor buried mechanical valves, controls, cleanouts, located in interior and exterior floor and grade areas.
- B. Provide access door over concealed mechanical valves, controls, duct coils, dampers, fire dampers, pipe chases, concealed mechanical equipment through fire rated walls and ceilings.
- C. Provide fire rated doors for access to mechanical equipment valves.
- D. Access covers – Interior concrete floors:
  - 1. Type: Square or rectangular frame with hinged and secured cover.
  - 2. Size: Nominal 10" x 10".



3. Construction: Aluminum alloy frame and hinged score rated XH cover with lifting device. Secure with vandal proof screws.
  4. Marking: Cast cover with words "CLEANOUT", "GAS SHUT-OFF" or "WATER SHUT-OFF" when used for these services.
  5. Acceptable manufacturers: Smith No. 4915, Zurn, Josam
- E. Access Covers – Interior vinyl/asbestos tile floors:
1. Type: Square or rectangular frame with recessed cover.
  2. Size: Nominal 10" x 10".
  3. Construction: Aluminum alloy frame and tile recess XH cover with lifting device. Secure with vandal proof screws at each corner.
  4. Acceptable manufacturers: Smith No. 4920, Zurn, Josam.
- F. Access Doors – Walls and ceilings:
1. Type: Flush or recessed panel.
  2. Size: Minimum 12" x 12" nominal door for hand access, minimum 16" x 20" nominal door for personal access.
  3. Location and style:

Masonry/concrete walls	Milcor "M" Standard
Gypsum wallboard walls and ceilings	Milcor "M" Standard
Plastered surfaces (except toilet and kitchen walls)	Milcor "K" Standard
Tile/terrazzo/kitchen/toilet room walls (with casing bead stainless)	Milcor "M" Standard
Acoustical tile (check type of ceiling system)	Milcor "A"
General areas	Milcor "M" Standard
Fire rated shafts, rated walls and ceilings	Milcor "B" Standard
  4. Material:
    - a. Stainless Steel, No. 302 with No. 4 finish.
    - b. Standard manufacturer's standard construction and finish for type specified.
  5. Locking:
    - a. Screwdriver: Flush screwdriver operated with case hardened cam.
    - b. Acceptable Manufacturers Milcor, Zurn, Miami, Carey, Potter-Roemer.

## **PART 3 - EXECUTION**

### **3.1 SUPERVISION**

- A. The Contractor shall furnish the services of a Superintendent experienced in the work of each section who shall be constantly in charge of the progress of the work, together with all the necessary journeymen, helpers and laborers required to properly unload, erect, connect, adjust, start, operate and test the work involved.

### **3.2 PROTECTION, CARE AND CLEANING**

- A. The premises shall be maintained as required by Division 1.
- B. Materials and Equipment:
  - 1. Effectively protect materials and equipment to be installed on a project against moisture, dirt and damage during the construction period, to the entire satisfaction of the Owner. Special care shall be taken to provide protective and similar equipment that are particularly vulnerable to grit and dirt.
  - 2. Keep interior of ductwork free of dirt, grit, dust, installation and other foreign materials at all times. Do not operate air distribution equipment until building is cleaned and air filters installed in order to prevent soiling of diffusers, ducts, air handling equipment, and buildings. Provide new set of filters after final acceptance of air distribution systems.
  - 3. Drain and flush piping to remove grease and foreign matter. Thoroughly clean out valves, traps, strainers, and demonstrate the cleanliness to the Owner.

### **3.3 EXISTING UTILITIES AND SERVICES**

- A. Location and character of principal existing utilities, including dimensions, as shown on the drawings for convenience only, are believed complete and correct, but shall be subject to verification by the Contractor, as the Owner assumes no responsibility for their correctness.

### **3.4 INTERRUPTION OF EXISTING UTILITIES OR SERVICES**

- A. Refer to Divisions 0 or 1.
- B. Submit for appraisal to the Owner a written schedule for the shutdown, removal, installation and connection of materials. Any shutdown of the existing utility services shall be coordinated as specified or advised.

### **3.5 EXISTING FACILITIES TO BE REMOVED**

- A. Utilities and related equipment: Remove existing equipment and utilities, indicated and cap or plug utility line air/water tight in a manner approved by the Architect. Remove equipment and deliver to a location in accordance with instructions of the Architect. If utility lines are encountered that are not shown on the drawings, contact the Architect for further instructions.

- B. Concrete Pads: Saw cut and remove concrete pads as indicated.
- C. Patching: Where removals leave holes on damaged surfaces exposed in the finished work, patch and repair those holes and damaged surfaces to match adjacent surfaces. Where new work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving a new work. Finished surfaces of patched area shall be flush with the adjacent existing surface as possible as to texture and finish.

### 3.6 DISPOSITION OF MATERIALS

- A. Refer to Divisions 1 and 2.

### 3.7 CLEAN-UP

- A. Debris and Rubbish: Remove and transport debris and rubbish in a manner that will prevent spillage on pavement, streets, or adjacent areas. Limits to 3/4 cubic yard capacity buggies or other conveyances used roofs and within the building to transport removed debris. Clean up spillage from pavement, streets and adjacent areas.

### 3.8 INSTALLATION

- A. General: Inspect the architectural, structural, plumbing, fire protection, special systems and HVAC drawings and specifications to become familiar with the building construction and to coordinate with the work of others.
- B. Piping: Install in strict accordance with manufacturer's written installation instructions and recommendations. Install in a manner that permits expansion and contraction caused by changes in temperature and pressure. Provide additional support as required. Run pipes straight and true, parallel to or at right angles to the building walls. Springing or forcing piping into place will not be permitted.
- C. Fixtures and Equipment: Install in strict accordance with manufacturer's written installation instructions and recommendations. Fixtures (except for handicapped) shall be roughed in only from fixture manufacturer's certified "Rough-In Measurement Drawings" which shall be submitted to the Architect for approval. Handicapped fixtures shall be installed in accordance with Title 24 California Administrative Code rough-in measurements adjusted from manufacturer's certified drawings.

### 3.9 STAGING AND HOISTING

- A. Provide all hoisting equipment, staging scaffold, ladders, barricades, shores or similar facilities required to properly carry out this work in accordance with all safety regulations.

### 3.10 EXCAVATION AND BACKFILL

- A. The Contractor shall do all necessary excavations and backfill for the installation of all work included in his contract.

- B. Excavation: Bury piping outside the building to a depth of not less than 3'-0" below finish grade unless otherwise noted.
- C. Excavations shall be as narrow as possible and shall be braced and supported as prescribed by the State Industrial Safety Commission. Excavations shall be cleared of all roots and other organic substances and debris. All debris and surplus earth shall be removed from the site. All excavations shall be free of water at all times.
- D. Backfill shall not be more than six-inch thick layers of properly dampened and solidly iron tamped approved earth or backfill material to a density of 90% compaction. Compacting by puddling will not be permitted.

### 3.11 ENCLOSURES AND BARRICADES

- A. The Contractor shall provide, install and maintain for the duration of the work as required, all lawful and necessary barricades and railings, lights, warning signs and signals and shall take other precautions as may be required to safeguard persons, the site and adjoining property, including improvements thereon, against injuries and damages of every nature whatsoever. This requirement applies continuously (24 hours, 7 days a week) for the duration of this contract and is not limited only to regular working hours.

### 3.12 CONTROL AND INSPECTION

- A. The Architect or Owner shall have the right to reject materials or workmanship which in his opinion are not in accordance with this contract, to interpret contract provisions and the meaning of the drawings and specifications.

The above named parties shall be allowed access to the work for observations at all times.

- B. Defective work in anyway contrary to the contract documents may be rejected without regard to state of completion, even though said work has not been rejected as a result of a previous observation.

### 3.13 SLEEVES, CUTTING AND PATCHING

- A. The Contractor shall be responsible for the sizing and timely placing of sleeves of all piping and insulation material passing through walls, partitions, beams, floors and roof while same are under construction. If a pipe is insulated, its pipe sleeve shall be larger than the outside diameter of the insulation around the pipe. Sleeves set in concrete floor construction shall be minimum 20 gauge galvanized steel. If holes and/or sleeves are not properly installed and cutting and patching becomes necessary, it shall be done at no expense to the Owner by parties approved by the Architect.
- B. All openings into existing masonry shall be core drilled or saw cut. The Contractor shall undertake no cutting or patching without first securing the Architect's written approval. Where a pipe passes through a sleeve, provide 1/2" minimum clearance. No joint of the pipe (or its insulation) shall touch the sleeve. Caulk around such pipe with sufficient layers of 1/8 inch neoprene and seal off opening between pipe and sleeve with non-hardening mastic.
- C. Caulking in fire walls or floors shall be made using a UL listed, fire-rated material. For pipe or conduit penetrations through fire rated floors, walls, partitions, ceilings, etc.,

provide firestop system complying with the UL "Fire Resistance Directory" for "Through Penetration Firestop Systems" (XHEZ). F and T ratings shall be as required by CCR Title 24, Part 2, Section 714 for the penetrated assembly. Representative systems for insulated pipe are WJ5005, WJ5007, WJ5009, and for non-insulated conduit CAJ1034. Do not continue insulation material through fire rated wall or floor.

### 3.14 ANCHOR BOLTS

- A. Furnish and install anchor bolts for all equipment placed on concrete equipment pads or on concrete slabs. Bolts shall be of the size and number recommended by the manufacturer of the equipment and shall be located by means of suitable templates. When equipment is placed on vibration isolators, the equipment shall be secured to the isolator and the isolator to the floor, pad, or support as recommended by the vibration isolation Manufacturer.

### 3.15 LUBRICATION

- A. Where Necessary: Provide means for lubricating all bearings and other machine parts. If a part requiring lubrication is concealed or inaccessible, extend a lubrication tube with suitable fitting to an accessible location and identify it.
- B. After Installation: Properly lubricate all parts requiring lubrication and keep them adequately lubricated until final acceptance by Owner.

### 3.16 INSTALLATION OF EQUIPMENT

- A. Floor mounted equipment shall be set on housekeeping pads extending 6" minimum beyond sides of the equipment. Housekeeping pads shall be 4" high (minimum) unless otherwise shown on drawings. The housekeeping pads and bases shall be of.
- B. Equipment shall be secured in place using fasteners as recommended by SMACNA's Guideline for Seismic Restraints of Mechanical Systems latest edition.
- C. Vibration Isolation: Vibration of motors, fans and other moving machinery shall be effectively isolated to prevent vibration transmission to building. Isolation shall prevent noise transmission through structure and slabs. Equipment shall be set on or suspended from neoprene and steel spring vibration dampeners of proper rating as specified herein, as shown on drawings, or as otherwise required. Fans and motors shall be secured to a common base.

### 3.17 INSTALLATION OF VALVES

- A. General:
  - 1. Valves shall be full line size unless otherwise noted. Automatic control valves are exempted.
  - 2. Valves shall have proper clearances for handle operation and shall close tight at the specified test pressure.
  - 3. Pump discharge check valves shall be of non-slam type.

B. Arrangement

1. Valves shall be installed in the systems so located, arranged and operated as to give complete regulation of all apparatus, equipment and fixtures.
2. Valves shall be installed for accessibility and easy maintenance.
3. Gate valves shall be installed with stems horizontal to vertically upright.
4. Provide valve box at each valve or cock in ground. Set cover flush with finished grade except in planted areas set 1" above grade.
5. Balance Valves: Install balance valves where shown and on each circulating return branch where two or more branches occur on domestic hot water system.
6. Provide readily accessible lubricated gas shut-off valve in gas supply to each gas burning appliance and ahead of union connection thereto, and in addition to any valve on appliance. Locate within 3'-10" of appliance.
7. Compression Stops: Install stop valve or compression stop on water supply lines to each plumbing fixture, including hose faucets. Where fixture from trim is specified with integral built-in stops, individual supply stops will not be required. Unions are not required adjacent to compression stops.
8. Hose Faucets: Mount with outlet 18" above finished grade or 12" above finished floor, unless shown otherwise.

C. Location:

1. In branches and/or headers of water piping serving a group of two or more plumbing fixtures.
2. On both inlet and outlet of all apparatus and equipment.
3. For shutoff of branch mains.
4. For flushing and sterilizing the systems.
5. Where shown on the drawings.
6. Ahead of each automatic control or regulation valve in water lines.

3.18 PIPE SUPPORTS

A. Installation:

1. Securely support piping from building construction with manufactured iron hangers, brackets, trapezes, guides, anchors and sway braces to maintain pipe alignment and prevent sagging, noise and excessive strain due to uncontrolled movement under operating conditions. Auxiliary secondary beams shall be furnished and installed under this division of the specifications wherever necessary to meet the requirements above.

2. Piping supports for each system shall be engineered as a system and the proposed system submitted for review.
3. Relocate hangers as necessary to correct unsatisfactory conditions that may become evident when system is put into operation.
4. Support of piping by wire, rope, wood or other make shift devices will not be permitted.
5. Burning of holes in beam flanges or narrow members will not be permitted.
6. Where calculated maximum travel due to thermal expansion exceeds 1", provide rollers at all types of supports.
7. Where rods exceed 12" in length for pipes 2" and larger and all trapezes, lateral sway bracing shall be provided at every third hanger. As a minimum, each straight run of pipe shall be equipped with a longitudinal sway brace at 40'-0" maximum. Sway brace rods shall either be two hanger or 1-1/2 x 1-1/2 x 1/8" angle iron to 2" and smaller pipe size and 2" x 2" x 1/4" for larger pipes, set on 45°. Secure bracing to pipe and structure as for hangers. All hanger rods not sway braced shall be fitted at the top with a swivel. In no case shall Code limits be exceeded.
8. Piping shall not be supported from roof decking. Furnish and install auxiliary steel members to span steel purlins to distribute the load. Refer to roof shop drawings for location of beams and purlins.
9. Sheet lead, lead wool or wood plugs shall not be accepted as a substitute of cinch anchors as a means of attaching materials and equipment to concrete.
10. Support for insulated pipe shall be outside the insulation. Protect pipe insulation at every hanger, support or guide with inserts and shields. The galvanized sheet shield shall be applied between the hanger or support and the pipe insulation. Provide saddles at all rollers of insulated pipe not equipped with inserts and shields.

### 3.19 IDENTIFICATION OF EQUIPMENT, PIPING AND VALVES

- A. Equipment Labels: All equipment furnished and installed under this section shall be provided with manufacturers metal labels securely attached to each individual piece of equipment and showing complete and comprehensive performance characteristics, size, model, serial number etc.
- B. Name Plate: Install engraved Bakelite nameplates with 1/4" high white letters for all [new and relocated equipment], switches, controls, room stats, damper motors, indicating zones, etc.
- C. Valves shall have tags attached with "S" mounting. Tags shall be at least 1-1/2 inches in diameter. Tags shall be stamped with valve I.D. number (e.g. V-1) and be keyed to valve identification table submitted as part of the Operating Instruction and Maintenance Manuals.

- D. Dampers: Mark all volume dampers above new or existing ceilings by attaching a bright yellow 12" length strip of cloth attached to damper rod. Groove ends of shafts to indicate open and closed position.
- E. Piping exposed to view shall have color coded markers as to type of use, service, and direction of flow in accordance with the latest edition of ANSI A 13.1. Locate markers at each valve, at entries to walls, and on 20 foot centers on straight runs of pipe. Provide a flow arrow at each identification marker. Labels or markers shall be made of plastic sheet with pressure sensitive adhesive suitable for the intended application.
  - 1. Color Coding for Labels and Bands by Hazard Classification:
    - a. Safe Materials – Green:
      - (1) Domestic cold and hot water – green with black letters.
      - (2) City water – green with white letters
      - (3) Chilled water – green with white letters
    - b. Dangerous Materials – Yellow:
      - (1) Natural Gas – yellow with black letters
      - (2) Industrial cold water – yellow with black letters
      - (3) Heating hot water – yellow with black letters
    - c. Fire Protection Equipment – Red:
      - (1) Fire Sprinkler Piping – red with black letters
- F. Nameplate designations shall correspond to the identifications on the "Record Drawings."
- G. Submit to the Architect for approval a list of items to be tagged within two (2) weeks after award of the Contract.

### 3.20 CLEANING

- A. Equipment, piping, ductwork, and related valves and appurtenances, etc. Clean so as to remove rust, scale, plaster or any internal obstructions before any covering is installed or any piping or equipment is painted. No scarring or disfiguring of equipment, piping, etc. will be acceptable before covering or painting is applied.
- B. Painted Work: All parts of the work, which are to be painted or which are exposed in the finished work shall be thoroughly cleaned and made ready to receive paint finish.
- C. Exposed Equipment: The exposed parts of equipment shall be cleaned, oil and grease removed, and the bright parts left clean and polished.
- D. Completion: Upon completion of the work, the Contractor shall remove all rubbish, debris and surplus materials, resulting there, from the premises together with all test instruments, and equipment and shall leave the site in a neat, clean and acceptable condition as approved by the Architect.

### 3.21 FLUSHING OF PIPE SYSTEMS



- A. Entire new and existing pipe systems shall be flushed and cleaned of all foreign matter before they are placed in service. The length and number of flushing cycles shall be governed by the complexity of the system, but in no case less than two (2) cycles.
- B. Flushing shall be performed using a similar media that is to be carried by the piping system. (Example: Cold water piping – water; etc.)
- C. Where pipe strainers have been designed or installed into the piping network, said strainers shall be opened and strainer baskets removed and cleaned several times during the flushing of the system.
- D. Chemical Cleaning: For chemical cleaning of closed circuit systems see Related Section.

### 3.22 CORROSION PROTECTION

- A. Protective coverings for underground steel piping shall be installed in strict accordance with manufacturer's written installation instructions.
- B. Testing: Covered pipe shall be tested with high voltage holiday tester in the presence of Owner's representative prior to backfilling all holidays shall be repaired and retested.
- C. Plastic sleeves, rubber seals, or other dielectric material shall be used to isolate piping from the building structure where steel piping penetrates concrete floor slabs or walls.

### 3.23 PAINTING

- A. Painting:
  - 1. Finish painting of mechanical equipment shall be as specified in Division 9, unless otherwise specified in Division 23.
  - 2. Equipment shall be provided with factory applied prime finish, unless otherwise specified.
- B. Touch-Up:
  - 1. If the factory finish on any equipment furnished by the Contractor is damaged in shipment or during construction of the building, the equipment shall be refinished by the Contractor to the satisfaction of the Architect.
- C. Concealed Materials:
  - 1. Uncoated cast iron or steel that will be concealed or will not be accessible when installations are completed shall be given one heavy coat of black asphalt before concealment.

### 3.24 ELECTRICAL WORK

- A. Furnish all electrical interlock wiring diagrams and complete sequences of operation for equipment specified in Division 16 that must interface with other electrical, mechanical, or control equipment. These diagrams shall be submitted to both the mechanical, and electrical engineers for review and coordination.

- B. Furnish any additional line or low voltage, mechanical and control system wiring and conduit required over and above that specified in Division 16 as required for complete and functional systems is hereby specified in this Division in complete conformance with the requirements outlined in Division 16 at no additional cost to the Owner.

### 3.25 PENETRATIONS

- A. All duct and pipe penetrations of ceilings shall be sealed air tight with silicone caulking prior to installation of escutcheon rings.
- B. All duct and pipe walls or slab penetrations shall be canceled using a UL listed fire rated material.

### 3.26 SEISMIC RESTRAINT CODE REQUIREMENTS

- A. Seismic Design: Contractor shall be responsible for all anchors and connections of mechanical work to the building structure to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. Provide structural calculations certified and stamped by a Registered Professional Structural Engineer in the State of California prior to installation.
  - 1. Equipment anchorage shall be as follows:
    - a. All mechanical equipment over 500 lbs., shall be braced or anchored in accordance with the regulations of Title 24, CCR and/or 2001 California Building Code and/or the following, whichever is most restrictive.
    - b. Where anchorage details are not shown on the drawings the field installation shall be subject to the approval of the Structural Engineer.
    - c. Where platform details, anchorage details, or location are not shown or are different than shown on the drawings, the field installation shall be subject to the approval of the Structural Engineer and the Division of the State Architect.

### 3.27 PRELIMINARY OPERATIONS

- A. Should the Owner require that any portion of the system or equipment be operated prior to the final completion and acceptance of the work, the Contractor shall furnish such operation. All the expense thereof will be paid, by the Owner separate and distinct from any money paid on account of the contract.
- B. For such preliminary operation, payment shall not be construed as final acceptance of any of the work of this contract.

### 3.28 OPERATING INSTRUCTIONS

- A. The Contractor shall provide the services of a competent Operating Engineer to supervise the operation of all equipment specified herein and to instruct the Owner's operators during a one day operating period. The operating instruction period shall be defined as straight time working hours and shall not include nights and weekends.

- B. The Owner shall be notified in writing at least five days before each operating instruction period begins. The Owner must indicate acceptance of the instructional starting time in writing to the Contractor. Upon arrival, the various instructors shall report to the Owner.

### 3.29 TESTS

- A. Tests must be performed and systems approved prior to painting, covering, insulating, furring or concealing piping.
- B. Provide all test equipment, instrumentations and labor in conjunction with tests.
- C. Prior to test, protect or remove all control devices, air vent and other items, which are not designed to stand pressure used in test.
- D. Accomplish testing of piping in section so as not to leave any pipe or joint untested.
- E. Obtain prior approval for test procedure.
- F. Responsibility for Damages: Contractor shall pay for costs for repair and restoration of work of other trades damaged by tests or cutting done in connection with tests.

### 3.30 REPAIRS AND RETEST

- A. Refer to related sections.
- B. Make other adjustments, repairs and alterations required to meet specified test results.
- C. Correct defects disclosed by tests or inspection; replace defective parts.
- D. Use only new materials in replacing defective parts; in case of pipe, replace with same length as defective piece.
- E. Repeat tests after defects have been corrected and parts replaced, until pronounced satisfactory.

### 3.31 MECHANICAL SYSTEMS STARTING

- A. Start-up all operating systems provided under Division 23.
- B. Demonstration of all operating systems provided under Division 23, including, but not limited to:
  - 1. Air Conditioning Unit
  - 2. Supply Fans
  - 3. Exhaust Fans
  - 4. Control System

- C. Sequencing: Conduct demonstrations only after systems have been through start-up procedures, systems are complete and operating and operating maintenance data is complete.
- D. Verification of Conditions:
  - 1. Existing conditions: Examine preceding work to ensure that all systems are operational.
  - 2. Verify with Division 26 contractor:
    - a. Temporary services are disconnected and permanent utility services are capable of full load.
    - b. Connections in main switchgear and subpanels are tight.
    - c. Necessary tests and check meter readings have been made.
  - 3. Mechanical:
    - a. Specified tests on piping systems have been made.
    - b. Specified cleaning of piping systems has been completed.
    - c. Piping: Conformance with drawings, specifications, and ANSI B31.1. Replace or correct work rejected because of defects or nonconformance with drawings, specifications and ANSI B31.1.
    - d. Water treatment has been completed.
    - e. Operational and performance tests have been made.
    - f. Each piece of equipment comprising part of system has been checked for proper control sequence, and any other condition which may cause damage to equipment or endanger personnel.
    - g. Verify pump rotations.
    - h. Verify strainers are clean. Operate system 24 hours and recheck.
    - i. Verify all control valves fully open and close.
    - j. Verify all vibration isolators are free to operate.
    - k. Verify all supply fans and exhaust fans operate.
    - l. Verify all heating and cooling equipment cool and heat as controller requests.
    - m. Verify all plumbing fixtures operate.
    - n. Verify water heater and control operate.
    - o. Verify integrity of all wiring.
    - p. Verify all sensors are provided and in correct location.
    - q. Verify range of each device and check software is compatible sensor calibration.
    - r. Test voltage on each input and output.
    - s. Test start/stop points to verify correct equipment operates.
    - t. Verify sequence of operation in all modes.
    - u. Check sensor calibration.
- E. Submit testing plan for review prior to testing. Indicate order of procedure, list items will be tested and order of testing show where all controllers and devices are located.
- F. Provide report indicating all equipment operated properly and as per sequence of operation.

### 3.32 START-UP TESTING

- A. Notification: Notify owner at least two days in advance of start-up of mechanical systems.
- B. Start-up and Testing: Conduct start-up and start-up testing in presence of owners. See applicable Division 23 Sections for specific requirements.
- C. Lubrication: Field check and field lubricate equipment requiring lubrication prior to initial operation.
- D. Code Authorities: Complete tests required by code authorities including smoke detection, fire protection and health codes.
- E. Control Systems: Ensure control systems are fully operational in manual and automatic modes.
- F. Test equipment before and after installation as applicable where necessary to determine compliance with specifications.
- G. Start-up and Testing: Conduct start-up and start-up testing in presence of Owner. See applicable Division 23 Sections for specific requirements.
  - 1. Periodically clean various strainers during initial operation until no further accumulation of foreign materials occurs. Exercise care so minimum loss of water occurs when strainers are cleaned.
  - 2. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence.
- H. Field Tests: Subject the work of Division 23 to necessary field tests after installation and before acceptance.
  - 1. Make proper corrections, repairs and replacements should tests reveal evidence of malfunction. Repeat tests until proper and successful operation is achieved.
  - 2. If final control settings and adjustments cannot be properly made to performance tests because of time of year, make field tests as first seasonal use of systems following completion of project.
- I. Cleaning and Adjusting: After test runs have been completed and systems have been demonstrated to be satisfactory and ready for permanent operation. Clean permanent pipeline strainers properly adjust valve and pump packings, secure drive guards in place, check lubrication and replenish if required.
- J. Protection: If systems are not to continue in use following start-up procedures, take steps to ensure against accidental operation or operation by unauthorized personnel.
- K. Instruct Owner's representatives once on proper operation and maintenance of mechanical systems. Include seasonal concerns and operations.
- L. Systems: All mechanical systems provided under Division 23. See applicable Division 23 Sections for additional requirements.

- M. Contractor's Representatives: Have thorough knowledge of particular installation and system.
- N. Manufacturer's Representatives: Have thorough understanding of each particular equipment and system.
- O. Scheduling: Arrange and schedule demonstration times with Owner.
- P. Location: Conduct demonstrations at Project including tours of systems.
- Q. Operating and Maintenance Date: Arrange for data to be at demonstrations. Include review of data at demonstrations.
- R. Time Allotment: Provide demonstration periods of following minimum time periods:
  - 1. 8 hours (HVAC).
- S. Control Systems: 8 hours for each building.

### 3.33 COMPLETION DATE AND TESTING OF MECHANICAL SYSTEMS:

- A. Final Acceptance Tests shall be sufficiently in advance of the contract completion date to permit the execution before that expiration of the contract of any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment.

Any such modifications shall be completed within the number of days allotted for completion of the contract. Retests shall not relieve the Contractor of completion date responsibility.

- B. Starting and Operation: Before starting or operating equipment of systems, make through check to determine that the systems have been flushed and cleaned as required and equipment has been properly installed, lubricated and serviced. Notify owner at least three days in advance of starting these tests.

### 3.34 PRELIMINARY OPERATIONS

- A. Should the Owner require that any portion of the system or equipment be operated prior to the final completion and acceptance of the work, the Contractor shall furnish such operation. All the expense thereof will be paid by the Owner separate and distinct from any money paid on account of the contract.
- B. For such preliminary operation, payment shall not be construed as final acceptance of any of the work of this contract.

### 3.35 OPERATING INSTRUCTIONS

- A. The Contractor shall provide the services of a competent Operating Engineer to supervise the operation of all equipment specified herein and to instruct the Owner's operators during a one day operating period. The operating instruction period shall be defined as straight time working hours and shall not include nights and weekends.

- B. The Owner shall be notified in writing at least five days before each operating instruction period begins. The owner must indicate acceptance of the instructional starting time in writing to the Contractor. Upon arrival, the various instructors shall report to the Owner.

### 3.36 FINAL REVIEW

- A. **Date and Time:** At a time designated by the Owner, the entire system shall be reviewed by the Architect. The Contractor shall be present at this review.
- B. **System Operation:** The system shall be operating properly within all water and air volumes balanced and all temperature controls adjusted. All labels shall be removed from the plumbing fixtures, and the fixtures shall be cleaned and in operating condition. Air and Water Balance Report shall be submitted to the Owner.
- C. **Documentation:** Certificates and documents required herein shall be in order and presented to the Architect at least two weeks prior to the review.
- D. **Changes and Corrections:** After the review, any changes or corrections noted by the Architect as necessary for the work to comply with these specifications and the drawings shall be accomplished without delay in order to secure final acceptance to the work.

END OF SECTION

**SECTION 23 09 00  
BUILDING CONTROL SYSTEM**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Section 23 05 00, "Common Work Results for Mechanical" applies to the work of this Section.
- B. The work listed or required by this section of the specifications is not intended to limit or establish the extent of the Building Control System work.

1.2 DESCRIPTION

- A. Work Included: The work includes the furnishing of labor, materials, appliances and tools necessary for the installation, in complete working order, of the Control System as herein specified and as indicated on the drawings. The items of work shall include, but shall not be limited to, the following principal items:
  - 1. Furnish labor, materials, equipment and service necessary for a complete and operating control system as shown on the drawings and as described herein.
  - 2. Furnish labor, materials and equipment necessary to meet the functional intent of the system as specified herein and as shown on the drawings. Drawings are diagrammatic only.
  - 3. Equipment and labor not specifically referred to herein or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner.
  - 4. Includes wiring inside system control panels, remote wiring between system control circuits and wiring for direct digital control systems that is not specifically shown to be included under Division 26. Wiring shall be installed per requirements of Division 26 and applicable local codes.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 23 05 00, "Common Work Results for Mechanical":
  - 1. Refer to other Division 23 sections for installation of wells, valve bodies and dampers in mechanical systems.
  - 2. Work designated specified or shown to be installed or performed by other sections of the specifications.
  - 3. Power wiring.
  - 4. Start-stop push buttons.
  - 5. Hand-off-auto selector switches.
  - 6. Pilot lights.



7. Fire alarm system including wiring devices and relays to stop and start systems in accordance with fire and smoke control sequence.
8. 120-volt power connections to control equipment as shown on mechanical or electrical drawings.

#### 1.4 EQUIPMENT RESTRICTIONS

- A. Refer to Section 23 60 00.

#### 1.5 SUBMITTALS

- A. Refer to Section 23 05 00.
- B. The Controls Contractor shall submit AutoCAD generate schematic drawings for the entire control system for review and approval before work shall begin. Included in the submittal drawings shall be a one-page diagram depicting the system architecture complete with a communication riser. Drawings shall include point-to-point wiring diagrams and must show temperature controls, start-stop arrangement for each piece of equipment, equipment interlocks, wiring terminal numbers and special connection information required for properly controlling the mechanical equipment. The submittal shall include a bill of material reference list as well as equipment sequences of operation.
- C. The submittals shall include manufacturer's catalog data describing each item of control equipment or component provided and installed for the project.
- D. The submittals shall include a specification compliance analysis for review and approval before work shall begin. The compliance document shall address each paragraph of the specification by indicating Comply, Exceed or Exception. Do not indicate Comply unless the proposed system exactly meets the paragraph requirement. If Exceed or Exception is indicated, then provide a clear and concise explanation of the variance from the specifications and the net effect this would have on the specified system performance.
- E. Upon completion of the work, provide two complete sets of drawings and application software on USB Drives. File drawings shall be the latest version of AutoCAD files.

#### 1.6 QUALITY ASSURANCE

##### A. System Manufacturer

1. The system manufacturer shall be a firm regularly engaged in the manufacture of a full line of pneumatic, electronic and computer based controls of the type required by this project. System manufacturer shall have maintained an installing, contracting and servicing field office, either factory owner or an exclusive factory authorized representative, in the local of this project for at least five years. The acceptable manufacturers is: "Carrier BACnet Controls"

##### B. System Contractor

1. The system contractor shall be the field office of the system manufacturer or system manufacturer certified contractor in the locale of this project. Contractors, wholesalers, dealers or other firm that is not the field office of the system manufacturer or system

manufacturer certified contractor will not be acceptable as the system contractor. The system contractor is: "Carrier Controls" or certified Carrier BACnet contractors.

C. Installation and Commissioning

1. Work described in this section shall be installed under the supervision of factory trained engineers and mechanics qualified for this work and in the regular employ of the system manufacturer's or system manufacturer certified contractor's field office. Engineering, programming, testing, calibration and checkout shall be performed by employees of the system manufacturer's or system manufacturer certified contractor's field office.

D. Underwriters Laboratory Listing

1. Components of the system shall be UL listed and labeled. The listing number and category shall be provided upon request by the Owner or his Architect or Engineers.

E. Wire and Conduit

1. Electrical wiring, wiring connection and conduits required for the installation of the building control system shall be provided by the control contractor unless shown on the drawings or called for in the specification to be under Division 16.
2. Wiring and conduits shall comply with the requirements of Division 16 and the local and national electrical codes. Communication and sensor cable may be installed without conduit in ceiling spaces where permitted by code.

1.7 SUBSTITUTIONS

A. Specified Equipment

1. The specified equipment is from one control manufacturer and is intended to establish the standard of quality and design features required. Equipment manufactured by others may be substituted; however, care should be taken that the proposed substitutions contain the design features and quality of the specified equipment.

1.8 SCOPE OF WORK

A. Contractor's Responsibilities: The Contractor shall furnish and install all necessary software and hardware, wiring, pneumatic tubing, and computing equipment in compliance with this specification and the main control station for the campus is located at the Physical Plant Operations Office. Any variances from this specification or related documentation shall be submitted in writing at the time of bid.

B. System Requirements:

1. Standard Material/Products. All material and equipment used shall be standard components, regularly manufactured and available, and not custom designed especially for this project.
2. Modular Design. The system architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.

3. Performance. The system, upon completion of the installation and prior to acceptance of the project, shall perform all operating functions as detailed in this specification.

C. Equipment:

1. System Hardware. The Contractor shall provide the following:
  - a. PC's, PDA's, server(s), routers, modems and control modules as specified.
  - b. All sensing devices, relays, switches, indicating devices, and transducers required to perform the functions as listed in I/O Summary Tables.
  - c. All monitoring and control wiring and air tubing.
2. System Software. The Controls Contractor shall provide all software identified in Part 2 of this specification, fully configured database, graphics, reports, alarm/events. The Graphical User Interface (GUI) shall be completely Web based as specified herein.

D. Input/Output Point Summary Schedule:

1. The system as specified shall monitor, control, and calculate all of the points and perform all the functions as listed in I/O Point Summary Schedule attached as Addendum A to this specification.

E. Codes and Regulations:

1. Standards Authority. All electrical equipment and material, and its installation, shall conform to the current requirements of the following authorities:
  - a. Occupational Safety and Health Act (OSHA).
  - b. California Electric Code and National Electric Code (NEC).
  - c. California Fire Code and National Fire Code.
  - d. California Mechanical Code.
  - e. California Plumbing Code.
  - f. California Building Code.
2. Product Applicable Standards. All distributed, standalone and unitary controllers supplied shall be in compliance with the following listings and standards:
  - a. UL916 for Open Energy Management (for U.S. and Canada).
  - b. FCC Part 15, Sub-Part B, Class A.
  - c. CE Electro Magnetic Compatability.
  - d. UUKL Optional: Only for Smoke Evacuation and where specified elsewhere.

3. **Manufacturer's Quality System.** The control system manufacturer shall be ISO9001 listed for design and manufacture of environmental control systems for precise control and comfort, indoor air quality, HVAC plant operation, energy savings and preventative maintenance. ISO Certification shall be by a registrar that is accredited by an internationally recognized organization such as BSI (British Standards Institute). Copy of ISO9001 certificate shall be submitted with bid.
4. **Conflict of Codes.** Where two or more codes conflict, the most restrictive shall apply. Nothing in this specification or related documentation shall be construed to permit work not conforming to applicable codes.

#### 1.9 GENERAL CONDITIONS

- A. **Changes in Scope of Work:** Any changes in the scope of work must be authorized by a written Change Order, and issued by Architect, in accordance with Contract conditions.
- B. **Correction of Work:**
  1. **Contractor's Responsibility.** The Contractor shall promptly correct all work Architect finds defective or failing to conform to the Contract Documents. The Contractor shall bear all cost of correcting such work.
  2. **During Warranty.** If, within the warranty period required by the Contract Documents, any of the work is found to be defective or not in accordance with the Contract Documents, the Contractor shall correct it promptly after receipt of a written notice from Architect to do so. Architect shall give notice promptly after discovery of the condition.
- C. **Coordination of Work During Construction:**
  1. The Contractor shall coordinate any necessary changes in work scheduling with Owner representative to minimize disruption.
    - a. The Contractor shall protect the installed works by other trades.
    - b. The Contractor shall coordinate with other trades.
    - c. The Contractor shall repair any damage caused by his work to building(s) and equipment at no additional cost to the owner.
- D. **Warranty:**
  1. The Contractor shall warrant, from the date of final acceptance by Architect, that all systems, subsystems, component parts, and software are fully free from defective design, materials, and workmanship for a period of one year or longer as indicated in this specification
    - a. A

#### 1.10 DOCUMENTATION, ACCEPTANCE AND TRAINING

- A. Documentation: Operating and Maintenance (O&M) manuals for the system shall be made available electronically and include the following categories: Workstation User's Manual, Project Engineering Handbook, and Software Documentation.
1. BAS User's Manual shall contain as a minimum:
    - a. System overview.
    - b. Networking concepts.
    - c. Launching a web browser from a networked PC and login.
    - d. Web Browser Graphical User Interface (GUI) screen menus and their definitions.
    - e. Creating, modifying or deleting schedules.
    - f. Uploading and downloading software to the field hardware.
    - g. Creating historical trends, collecting trend data and generating trend graphs.
    - h. Enabling and assigning alarms and messages to reporting actions/groups.
    - i. Report generation and 'third party software'.
    - j. Backing up software and data files.
  2. Project Engineering Manual shall contain as a minimum:
    - a. System architecture overview and networking configuration.
    - b. Hardware cut-sheets and product descriptions.
    - c. The Contractor shall deliver [x] sets of 'as-built' drawings. All drawings shall be reviewed after the final system checkout and updated to provide 'as-built' drawings. The system will not be considered complete until the 'as-built' drawings have received their final approval.
    - d. Installation, mounting and connection details for all field hardware and accessories.
    - e. Commissioning, setup and backup procedures for all control modules/accessories, software and database.
    - f. Listing of basic terminology, alarms/messages, error messages and frequently used commands or shortcuts.
  3. BAS Software Documentation shall contain as a minimum:
    - a. The Contractor shall provide all Graphical Programs, detailing their application to specific HVAC equipment and electrical/mechanical subsystems, together with a glossary or icon symbol library detailing the function of each graphical icon. Revisions made as a result of the submittal process, during the installation, start-

up or acceptance portion of the project, shall be accurately reflected in the “as-built”.

- b. Graphical representation of the mechanical equipment hierarchy for the project including all equipment controlled by the BAS. For example: a VAV terminal box may be the source for increased cooling demand and require the primary VAV AHU to operate which, in turn, requires the chillers to operate.
- c. Detailed listing of all alarm and event messages programmed for designated mechanical/electrical equipment and required operator action.

**B. Acceptance Test:**

- 1. Acceptance Testing. Upon completion of the installation, the Contractor shall start up the system and perform all necessary calibration, testing and debugging operations. The Contractor in the presence of the Owner’s representative shall perform an acceptance test.
- 2. Notice of Completion. When the system performance is deemed satisfactory, the system parts will be accepted for beneficial use and placed under warranty. At this time, [Your customer] shall issue a “notice of completion” and the warranty period shall start.

**C. System Training:**

- 1. System Use Instructions: Controls Contractor shall provide full Computer Based Training (CBT) in addition to training of designated personnel in the operation, maintenance and programming of the system.

**1.11 MAINTENANCE AGREEMENT**

- A. The system contractor shall provide its standard full maintenance service agreement for execution by the Owner. The fee for the warranty periods shall be marked “prepaid” on the agreement. The fee for subsequent years shall be indicated on the agreement. The agreement shall provide for cancellation at anniversary date so that continuation of the agreement after the warranty period is optional on the part of the Owner.

**1.12 SOFTWARE LICENSE AGREEMENT**

- A. The Owner may be required to sign a copy of the Manufacturer’s standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of programs and application software to Owner, but shall protect Manufacturer’s rights to disclosure of trade secrets contained within such software.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. The Environmental Control System shall be comprised of a network of various independent stand-alone Digital Controllers (SDC), Unitary Digital Controllers (UDC), together with Centralized Control Stations (CCS), interconnected in Local Area Networks (LAN).

- B. Provide latest "Intel" Processor PC Work Station, 17" monitor and HP color laser printer.
- C. Stand-Alone Digital Controllers (SDC)
  - 1. General
    - a. Stand Alone Digital Controllers (SDC) shall be 16 bit microcomputer based, providing a multi-tasking, multi-user operating system.
    - b. The SDC controllers shall permit the simultaneous operation of control, communication and operator interface software as programmed by the Contractor or User. Modification of the on-board SDC controller database shall be performed on-line using the built-in keypad or a Portable Operating and Service Terminal (POST). Proposed substitution, which requires the SDC to be removed from service while control sequences are modified will not be acceptable.
    - c. SDC controllers shall utilize true floating arithmetic capabilities.
  - 2. Agency Approvals
    - a. The SDC controllers shall be tested and approved by the manufacturer as conforming to FCC Part 15, Subpart J: Class A Compliance.
    - b. SDC's applied to mechanical systems shall be UL listed or recognized under UL916 or UL873 for control of mechanical systems or temperature regulating systems.
  - 3. Database and Memory Back Up
    - a. Programming defining the function to be performed by the SDC, including but not limited to application programs and point database within each SDC, shall be protected from loss due to power failure for a minimum of six months. Systems providing nonvolatile memory shall include Battery back-up sufficient to provide protection for a six-month period.
  - 4. Service Port
    - a. SDC controllers shall be equipped with a minimum of one service port for the connection of a Portable Operating and Service Terminal (POST). The service port shall be either a built-in RS-232 data terminal port of RJ-11 type jack which connects to manufacturers standard POST.
    - b. Connection of a POST to a service port shall not cause the SDC controller to lose communications with its peers or other networked device controllers.
    - c. Connection of a POST to a service port shall allow communications with SDC's on that BUS, including modification of program variables and commands.
  - 5. Service and Operator Interface

- a. The cover of each SDC shall contain a built-in service and operator interface consisting of an alphanumeric two (2) line by 20-character LDC and multifunction keyboard. Using this interface at SDC's shall allow communications with SDC's on the BUS, including modification of program variables and commands.
- b. Proposed substitutions which do not include a built-in service and operators interface shall include a Portable Operating and Service Terminal (POST) built into a panel mounted adjacent to each SDC.
- c. The built-in service and operator interface shall allow adjustment of control parameters such as set points, throttling ranges, etc.
- d. The SDC controller shall additionally provide diagnostic LED indication of device transmit and receive, data communications, normal operation, abnormal operation and control relay positive.

#### 6. Manual/Auto Control and Notification

- a. The SDC controller shall provide commanded software override capability from the POST or the built-in interface. Such overrides shall be enunciated to the CCS. Such overrides shall be valid as long as power is continuously applied to the controller or they are not changed from the CCS.
- b. Manual service overrides such as Hand/Off/Auto switches shall be provided. Such overrides shall be located at the controlled device location and conform with OSHA manual lockout regulations as appropriate for safety reasons.
- c. Proposed substitutions which include built-in H/O/A switching devices with integral feedback shall also include external manual service overrides as indicated to comply with OSHA manual lockout regulations.

#### 7. Control Outputs

- a. Each on/off output shall have an internal test point for the purpose of trouble shooting whether the 120 VAC circuit to the Contractor is active. Output relays or digital output modules shall have a pilot light or LED display of its status.
- b. Modulating outputs shall be industry 0-5 VDC, 0-12 VDC, 0-20 mA or 4-20 mA. Drive open/drive closed type modulating outputs shall include feedback of commanded position signal to the actuating device. This feedback signal must provide either a 0-100 percent position indication, or read out directly in the engineering units of the signal being used. Proposed substitutions with drive open/drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement.

### D. Unitary Digital Controllers (UDC)

#### 1. General

- a. Controls shall be microprocessor based, unitary air handling unit Direct Digital Controllers, UDC's shall be provided for air handling units, fan coil units, secondary chilled pumping loop systems and hot water heating system as shown



on the drawings. UDC shall be based on a minimum 1 bit microprocessor working from software program memory, which is physically located in the UDC. The software control "intelligence" shall be resident within the same enclosure as the circuitry which translates sensor signals into digital information.

- b. Provide a minimum of one UDC for each fan coil unit, air handling or mechanical system unless otherwise shown on the drawings. Fan coil UDC's shall have analog output to drive proportional heating and cooling control valves.
- c. The Control System Contractor shall furnish, install, calibrate, service and warranty UDC's specified under this section.
- d. Each UDC shall be in continuous direct communication with the CCS on the BUS.

## 2. Non-Volatile Memory

- a. Control sequences programmed into the UDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained. Power failures shall not cause the UDC memory to be lost, nor shall there be need for batteries to be recharged or replaced.
- b. Control parameters shall be fully field modifiable at the UDC controller and from a CCS.

## 3. Ambient Rating

- a. To allow controller locations on unconditioned spaces, UDC's shall operate normally in ambient conditions from 40 °F to 140 °F (4 to 60 °C).
- b. If the standard literature of proposed substitute controllers does not indicate normal operation up 140 °F.

## 4. Room Sensors (Thermostats)

- a. Unless otherwise noted, temperature sensors located in conditioned spaces shall have blank, locking covers. Finish shall be manufacturer's standard, except where otherwise noted on drawings.
- b. Room sensors shall have space temperature and set point signal precision tolerance of no greater than 1 °F.
- c. ASHRAE 90 – 75 Compliance
  - 1) Room temperature sensors shall be provided with software programmable dual set points. Dual set point devices shall be provided with an interlock which provide a programmable heat/cool deadband.
- d. Occupant Override of Unoccupied Mode
  - 1) Each room sensor for unit heaters shall have an integral momentary push-button which can be depressed by an occupant during unoccupied

mode of the unitary fan coil unit. This push-button shall cause the UDC to bring the unitary fan coil to occupied set points for one override period of a duration adjustable between 1 and 240 minutes. Should an occupant depress the push-button again, later, UDC shall begin timing an additional override period. Override operation time shall be accumulated to allow generation of reports indicating override usage.

2) For airconditioning unit, provide a 0 to 8 hour bypass timer on first floor.

e. Occupant Control

1) Occupants of the space served by the unitary fan coil units shall have adjustments integral to the room sensor allowing them to adjust local cooling/heating set points.

2) The above occupant control functions can be monitored, overridden and remotely modified by an operator with appropriate password level. Operators shall have access to these functions from standalone digital controller on the network having a built-in interface or via a plug in POST at wall sensor or device location on the BUS.

f. Service Port Connection

1) Unless otherwise shown, temperature sensors shall be provided with a plug-in RJ-11 type communications jack for connection to a POST. The communications jack shall be concealed under the cover to prevent tampering.

2) The same POST shall be connectable at wall sensor locations as well as other SDC and UDC device locations. Upon connection to a wall sensor, its corresponding SDC or UDC address shall be automatically displayed on the POST for the operator.

3) The connection of a POST at a wall sensor shall permit the operator to communicate with all other devices on the BUS.

4) The POST connection shall not cause the UDC or SDC through which the POST is connected to leave the communications network or generate an exception or be removed from service.

E. Centralized Control Station (CCS)

1. The system shall include Centralized Control Stations as shown. CCS's shall control communications with the SDC's and UDC's and serve as a centralized facility operator station providing facility wide access for review and modification of global control strategies and centralized documents.

2. A CCS shall support both a monochrome operator's terminal and serial printer. The CCS shall allow logging of alarms, trend logs, energy reports and review of specific facility information by operators.

3. The CCS shall not require a computer with RAM memory and disk storage for operation.

4. Operator Interface: Each CCS shall have built into its cover a data terminal consisting of a four line by 20 character LCD and a full alphanumeric key.
5. Operations
  - a. The user shall penetrate the system via menu prompted commands. Data entry selection shall be via cursor keys or via keyboard entered command strings, which uniquely identify the command, the system shall provide a list of choices of user selection.
  - b. The system shall provide logical groups of selected current point status for each SDC within the system.
  - c. The system shall provide password protected logical system displays of selected variables, which may be changed by user with appropriate password level. A minimum of one display shall be provided per SDC in the system.
6. CCS Program Changes: Each CCS shall enable the operator to access controllers in the network.
7. Exception Log
  - a. The CCS shall receive and output exception reports of device exceptions including alarms, diagnostic and facilities management exceptions.
  - b. The CCS Exception Processing Program shall permit an operator to access an SDC exception log, and acknowledge alarms.
8. Report Generation
  - a. The CCS shall produce reports of devices connected to the LAN, including module lists and module detail reports.
  - b. The CCS shall produce SDC device exception reports to be output on demand by the operator.
9. Remote Site Communications: The CCS shall permit communication to remote sites via a 2400 baud modem. The user shall enter the site phone number causing the CCS to dial up the site and gain access.

#### F. Local Area Networks

1. Error Checking: The LAN shall utilize packetized transmissions, CRC 16 error checking and distributed error recovery. Single or multiple SDC or UDC failures shall not cause loss of communication between other LAN connected controllers still active.
2. Communication Watchdog: LAN-connected controllers shall be provided with a communications watchdog to assure that an individual controller cannot permanently occupy the LAN. If a controller is determined to be monopolizing communications, it shall be automatically shutdown and an exception reported to annunciate this fact.

3. Transmission Format: The Local Area Network shall utilize industry standard data transmission formats such as IEEE 802.3 (peer-to-peer) or ANSI X3.28. The content of messages shall be the manufacturers standard. The Local Area Network components shall be manufacturers standard or available from third party vendors, which utilize the same chip implementation as used by the manufacturer.
4. RS-485 Network Trunk System
  - a. Wiring Practices
    - 1) The distributed communication network system shall consist of a multi-drop RS-485 bus architecture connecting SDC's and UDS's. The trunk shall consist of:
      - (a) A twisted pair of wires (24 awg) completely encased in continuous metallic conduit.
      - (b) or a twisted shield pair of wires (24 awg) with the shield grounded in accordance with the manufacturers wiring practices.
    - 2) There shall be no power wiring in excess of 40 VAC peak voltage run in conduit with communications trunk wiring. In cases where power or signal wiring is run in conduit with truck wiring, communication trunk wiring and power wiring shall be run using separate twisted shield pairs (24 awg) with the shields grounded in accordance with the manufacturer's wiring practices.
  - b. Transient Protection: The manufacturer's catalog data sheet shall provide evidence that the manufacturer's SDC and UDC products are tested and comply with IEEE-587 Categories A and B (ANSI C62.41) standard for transient surge withstand capabilities for electrical devices. Such testing shall have included power and communication trunk wiring. Compliance with IEEE-587 shall imply conformance with IEEE-472 transient standards, as IEEE-587 is a higher energy level test.

#### G. Portable Operating and Service Terminal (POST)

1. Provide a laptop personal computer with manufacturer's standard software for use as a POST. It shall be battery powered and have a 120 VAC line adaptor. Provide network controller interface for connection to SDC's, CCS's and UDC's.
2. Device capabilities shall include an 8 line x 40 character LCD, full ASCII keypad, plug-in 128k byte RAM cards, library of manufacturer's interface software and serial/parallel interface adaptor.
3. The POST shall be provided with software which allows the operator to view, edit, modify, override or record sequences, schedules, set points and other parameters contained in SDC's and UDC's on the BIS by connecting the POST to a controller or temperature sensor.

#### H. Damper Actuators

1. Electric damper actuators shall be properly sized to provide sufficient torque to position the damper throughout its operating range. Pneumatic actuator operating in series or parallel to another actuator or open loop such as minimum percentage outside air shall be equipped with a positive positioning device.

#### I. Sensors

1. Sensing inputs shall be provided via industry standards signals. Temperatures, humidities, differential pressure signals and other signal outputs shall be one of the following types:
  - a. 0-20 mA
  - b. 4-20 mA
  - c. 0-5 VDC
  - d. 0-12 VDC
  - e. 1000 ohm platinum (at 0 °F, 2.62 ohms/C)
  - f. 1000 ohm Balco (2.2 ohms/ °F)
  - g. 10 ohm thermistor (at 25 °C/77 °F)
2. Signal inputs shall be compatible with the controllers used, and with the requirements for readouts of variables in true scaled engineering units as specified.

#### J. Sensors

1. Room Sensors:
  - a. Temperature sensors located in conditioned spaces shall have blank, locking covers. Finish shall be manufacturer's standard, except where otherwise noted on drawings.
  - b. Room sensors shall have space temperature and set point signal precision tolerance of no greater than 1°F.
  - c. Each room sensor shall be provided with a plug-in jack for the manufacturer's portable operators and service terminal (POST).
  - d. To accommodate zones with multiple VAV terminal units, each room sensor/set point shall be capable of being connected simultaneously to up to four VAVDC's.
2. Compliance with Standards:
  - a. To allow mounting in return air plenums, the VAVDC enclosure shall be constructed to comply with the requirements of UL 465.
  - b. To comply with ASHRAE 90-75 room temperature sensors shall be provided with software programmable single or dual set points where indicated on the

drawings. Dual set point devices shall be provided with an integral software interlock, which provides a programmable heat/cool deadband.

3. Occupant Control:

- a. Occupants of the space shall have adjustments integral to the room sensor allowing them to adjust local cooling and/or heating set points.
- b. The above occupant control functions can be monitored, overridden and remotely modified by an operator with appropriate password level. Operators shall have access to these functions from a stand-alone digital controller on the network having built-in interface or via a plug in POST a wall sensor or device location on the BUS.

4. Service Port Connection:

- a. Temperature sensors shall be provided with a plug-in RJ-11 type communications jack for connection to a POST. The communications jack shall be concealed under the cover to prevent tampering.
- b. The same POST shall be connectable to wall sensor locations as well as other SDC, UDC and VAVDC device locations.
- c. The connection of a POST at a wall sensor shall permit the operator to communicate with other devices on the BUS.
- d. The POST connection shall not cause the VAVDC, UDC or SDC through which the POST is connected to leave the Communications network or generate an exception or be removed from service.

5. Controller Pint Capacity:

a. Cooling Only Units:

1) The VAVDC controller shall provide input/output points as follows:

- (a) Self-calibrated Velocity Pressure Input (0-2" WC). The velocity pressure transducer shall be a continuously self-calibrating unit, which determines the 0 velocity pressure point by equalizing the pressure across the sensing element every 10 – 15 seconds.
- (b) Room Temperature Input.
- (c) Occupancy Override Input.
- (d) Occupancy or Status Inputs.
- (e) 0 – 100% Position Indication of Primary Actuator.
- (f) Room Set Point Input.
- (g) Auxiliary Temperature Input

(h) POST Interface.

b. Heating Units:

- 1) In addition to the inputs and output points described for cooling only units, controllers which are heat configurations shall provide the following additional control points:

(a) A 4-20 mA (0-10 VDC) true proportioned analog output signal for control of a proportioning hydronic reheat valve.

## 2.2 SOFTWARE

### A. General

1. Contractor shall provide software for a complete and operational system as described herein. Software shall include manufacturer's standard multi-tasking, multi-user operating system for operator consoles and controllers, network communication software for dial-up and hard trunk applications, operator man-machine interface software, control application software and other software necessary to provide the function specified herein.
2. System software shall be manufactured by the system manufacturer. Software products manufactured by outside vendors will not be acceptable.

### B. Local Area Network Software and Operations

1. Network Shared Data: The system local area networks shall provide for the sharing of calculated and control point variable values throughout the network. The contractor shall provide network software links as necessary to provide a complete and functioning system.
2. Network Diagnostics
  - a. The CCS System shall provide software utilities to determine the on-line status of network connected panels.
  - b. If an SDC or UDC drops off-line, the network software shall detect and annunciate such conditions to the proper output devices.
3. Network Performance
  - a. The communication networks shall provide end-to-end data transmission of necessary control point values at a minimum rate of that established by standard NFPA-90A for smoke control operation.
  - b. The nominal network response speed for a data request entered at a man-machine interface for data contained in another panel shall not be greater than 30 seconds.
  - c. Network failure (i.e., device on/off line) shall be self-recovering and not require a manual initiation of the network.

4. Segregation of Information Reporting: The network shall support the segregation of messages by class of data to groups of output devices. The network control software shall provide a minimum of 5 classes of segregation. One class of information may be sent to a group of multiple input/ output devices.
5. Multi-user Operations
  - a. The network control software shall support the simultaneous operation of the system by multiple users (minimum of 5). Data requests from a operator shall be automatically routed and responded to using the token passing control methods of IEEE standard 802.3.
  - b. SDC panels which originate alarm, maintenance or other information shall automatically have their messages routed to the appropriate device without operator intervention.
6. Distributed System Access
  - a. Facility Wide Access: LAN connected CCS shall provide access to other LAN connected CCS's and their associated UDC units. Access shall be supported both via the integral operator keypad and through locally connected Portable Operating and Service Terminal (POST).
  - b. Access Restriction: SDC's shall include integral devices with full alphanumeric display and a keypad for password controlled access to various levels of operation capability, from simple information access, to full programmability of functions.

C. Stand Alone Digital Controller (SDC) Software

1. Multi-Tasking: SDC operating system software shall be multi-tasking. The multi-tasking capability of the SDC shall provide the capability to simultaneously perform at least, but not limited to, the following functions:
  - a. Downloading of application program changes to the SDC without affecting the simultaneous operation of existing application programming.
  - b. Printing of scheduled or on-demand reports without preempting operator functions.
2. Standard Software Function Libraries
  - a. SDC's shall have as a standard feature of their system software, complete libraries of control algorithms for DDC, Energy Management, and Facilities Management functions.
  - b. These resident libraries of algorithms shall be drawn from for the creation of the application programming of each individual SDC.
  - c. Requests for substitution of controllers which provide customer application software via line-by-line programs shall not be acceptable unless source and compiled program code is contained in totally non-volatile, but programmable



EPROM firmware to facilitate the on-line modification of application control sequences.

- d. The Contractor shall utilize these libraries to satisfy the sequences of operation specified herein. Requests for substitution of systems which create these programs utilizing line-by-line programming methods in languages such as PASCAL, BASIC "C" or similar shall include the cost of providing the Owner with fully annotated source code of application software modules used in a 10 year escrow of such source code in a third party location.

3. Read Out of Items

- a. Items specified for read out shall be under polled or continuous display on the face of the panel with either a digital display or analog electronic meter. The system shall provide for a minimum of 20 values per SDC panel with displays as indicated in the locations shown on the drawings. Read out of sensed variables used in control sequences shall be from the same sensors used for control.
- b. Each read out item shall be individually named and labeled. Name label shall be directly adjacent to the actual display value of that item including the applicable engineering units. Label shall be a part of the digital display of that value, or a Bakelite label mounted directly above the value display. Display readout requirements are in addition to capabilities provided by Portable Operating and Surface Tool (POST), which are provided as part of digital controller-based systems.

4. Adjustments

- a. Each SDC shall provide adjustments for the functions specified. In general, adjustments shall be provided for set points used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be made at each control panel. The method for adjustments shall be a dedicated adjustment pad or individual adjustment potentiometers providing direct input to the affected loop controller or sequence controller.

5. SDC Alarm Dial Out

- a. The SDC system shall provide built-in software with capability to dial out an alarm up to 10 remote reporting locations.
- b. Based on time of day or an event initiated program, the SDC software shall permit an alarm to select one of three dial up tables. Each table shall consist of a subset of the 10 phone numbers.
- c. The alarm shall cause the selected table to dial out and report the alarm to phone numbers listed in the table selected.
- d. Reporting of an alarm to only a single phone number in the table shall not be acceptable as it negates the need to notify the Owner and a service contractor and the person on call, if necessary.

6. Portable Operating the Service Terminal (POST)
  - a. General
    - 1) The Contractor shall provide software for use on the POST. The POST software shall display commands and data entry templates using pop-out, English language menus.
    - 2) The POST software shall allow the same POST to be connected to a device type on the controller network. Connection shall be via a manufacturer's supplied cable interface for wall sensor locations and an RS-232 cable at SDC service port locations.
  - b. Access
    - 1) The POST shall allow a user to access to UDC controllers to the BUS. The user shall be able to communicate with UDC controllers with or without a parent CCS on the BUS and to modify parameters, sequences, upload and download programs.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION AND SUPERVISION**

- A. Work described in this section shall be installed under the supervision of factory trained engineers and mechanics qualified for this work and in the regular employ of the system manufacturer's or system manufacturer certified contractor's field office. Engineering, programming, testing, calibration and check out shall be performed by employees of the system manufacturer's or system manufacturer certified contractor's field office.

#### **3.2 APPLICATION SOFTWARE DOCUMENTATION**

- A. Contractor shall provide AutoCAD blueprint documentation of the software application program for each SDC. Documentation provided shall include blocks software flowchart showing the interconnection between each of the control algorithms and sequences. For systems utilizing program listings, a program listing shall be printed onto the same blueprint, along with the program flowchart, and description of the sequence of operation. This blueprint shall be stored and maintained in each SDC panel. System acceptance shall not be completed until this documentation is provided and located in each panel.

#### **3.3 ACCEPTANCE TESTING**

- A. General:
  1. The system contractor shall perform acceptance testing on the system to verify its correct operation. Although some test routines may be performed of the site, the owner shall be notified to all routine dates and places and be invited to have its employees or agents witness tests.
- B. Acceptable Test Submittals

1. The system contractor shall submit for approval by the Architect an Acceptance Testing Manual which describes in detail each proposed test routine:
  - a. The purpose of the test routine.
  - b. The detailed procedure for the test routine.
  - c. The location of the test routine.
  - d. The forms to be completed during the test routine.

#### C. Test Routines

1. General
  - a. At least the following test routines shall be performed. Detailed test result forms shall be maintained. Their personnel performing each test routine shall certify the accuracy of the test results.
2. Engineering Review
  - a. The purpose of this routine is to verify that the appropriate hardware, programs, parameters and graphics have been chosen to comply with the plans and specifications.
  - b. This test will be performed by comparing the proposed equipment and programs with the project plans and specifications to ensure that required sequences of operation will be provided.
  - c. Documentation shall include detailed program and graphic names and parameters for each specific program.
3. Software Simulation
  - a. The purpose of this routine is to verify that new or revised sections of program code have been successfully debugged and shall operate according to the design standards.
  - b. This shall be performed by simulating inputs such as temperatures, pressures and binary inputs to each section of code and/ or function blocks and observing the actions of the programmed outputs.
  - c. Documentation shall include description of the test, simulated inputs, a record of the outputs and a certification that the section of program code performs the required tasks.
4. Database Download
  - a. The purpose of this routine is to verify that the software has been correctly downloaded to the hardware modules.

- b. This shall be performed by observing that communication has been established with each module and the download is proceeding and after the download is completed observing that no errors have been reported.
- c. A report shall be provided indicating the date that the software was loaded and the initials of the party performing the loading.

5. Module Communications

- a. The purpose of this test is to verify that the wires from each input device are correctly terminated at the DDC module.
- b. The test shall be performed by exercising (i.e. either opening or shorting the wires) each input device and observing the resultant change of state.
- c. The forms for this test shall include the device name, the device hardware address, the date of the test and the initials of the individual performing the continuity test.

6. Input Accuracy

- a. The purpose of this test is to calibrate the DDC reading to the actual value of the measured analog input.
- b. This test shall be performed by measuring the actual analog input with an agreed standard, such as a digital thermometer, and calibrating the DDC reading to agree with this value.
- c. The form for this test will include the following:
  - 1) The name of the point.
  - 2) The hardware address of the point.
  - 3) The actual value read.
  - 4) The correction of the DDC Systems' span and offset.
  - 5) The initials of the person performing the test.

7. Output Continuity

- a. The purpose of this test is to verify that the wires to each output device are correctly terminated at the DDC module.
- b. This test shall be performed by activating each output at the DDC module and observing the resultant operation of the required field device.
- c. The forms for this test shall include the device name, the device hardware address, the date of the test and the initials of the individual performing the continuity test.

8. Output Accuracy

- a. The purpose of this test is to calibrate the DDC software to the actual analog operating ranges of the modulating controlled devices.
- b. This test shall be performed by adjusting each DDC analog output through its entire output range and observing the points at which the controlled device begins its stroke and at which the controlled devices end its stroke.
- c. The form for this test shall include the following:
  - 1) The name of the point.
  - 2) The hardware address of the point.
  - 3) The beginning and ending points of the controlled device stroke.
  - 4) The date of the test.
  - 5) The initial of the person performing the test.

9. Alarm/Report Test

- a. The purpose of this test is to verify that required alarm and report functions are operational and will report to the chosen devices.
- b. The binary alarm test shall be performed by simulating the required alarm contract conditions at the DDC module digital input and observing that the corresponding alarm is annunciated at the correct devices.
- c. The analog alarm test shall be performed by adjusting the alarm limits such that the actual sensor value is outside of the limits and observing that the corresponding alarm is annunciated at the correct devices.
- d. The operator requested report test shall be performed by having the host operator request each report and observing that the correct report is displayed and/ or printed.
- e. The automatic report test shall be performed by simulating the circumstance that generates the report (i.e. time of day, end of month, etc., and observing that the correct report is displayed and/ or printed.
- f. Documentation shall include point name, report name, hardware address, date of test and the initials of the person performing the test. A hard copy of the alarm and report print out should be included where practical.

10. Control Loop Tuning Test

- a. The purpose of this test is to verify that the software closed loop control functions operate correctly.

- b. This test shall be performed by upsetting the loop (usually by hanging the set point) and observing that the controlled variable moves to the new set point without excessive cycling or delay.
- c. Documentation shall include point name, report name, hardware addresses, calibration parameters, ie. proportional band, switching differential etc., date of the test and the initials of the person performing the test. Additional documentation such as trend or graphic logs shall be printed and included where possible.

11. Communication Test

- a. The purpose of this test is to verify that information is correctly shared among DDC modules on the LAN.
- b. This test will be performed by simulating the information to be shared i.e. the starting of or stopping of a fan or pump in another DDC module, and observing that the required action does not indeed occur.
- c. Documentation shall include a description of the test and a certification that the communication functions operate correctly.

3.4 TRAINING

- A. Provide two periods of 4 hours training and instruction to Owner's personnel.

3.5 WARRANTY ACCESS

- A. The Owner shall grant to the Contractor, reasonable access the system during the warranty period. The Owner shall provide at no cost to the Contractor, a dedicated voice grade telephone extension for remote telecommunication during this period.

END OF SECTION

**SECTION 23 60 00**  
**HEATING, VENTILATION AND AIR CONDITIONING**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Section 23 05 00, "Common Work Results for Mechanical" applies to the work of this Section.
- B. The work listed or required by this section of the specifications is not intended to limit or establish the extent of the Heating, Ventilating and Air Conditioning work. The General Contractor shall be responsible for determining the extent of work to be done under a subcontract.

1.2 DESCRIPTION

- A. Work Included: The work includes the furnishing of all labor, materials, appliances and tools necessary for the installation, in complete working order, of the Heating, Ventilating and Air Conditioning System as herein specified and as indicated on the drawings. The items of work shall include, but shall not be limited to, the following principal items:
  - 1. Equipment including, air-conditioning units, exhaust fans, supply fans, etc., as indicated on the drawings.
  - 2. Air distribution system, including ductwork, diffusers, registers, dampers, etc.
  - 3. Provide new filters for all air-conditioning units prior to functional performance tests.
  - 4. Insulation for ductwork and piping.
  - 5. Condensate drain piping from air-conditioning units to the drain receptors.
  - 6. Exhaust and supply systems including fans, drives, ductwork, registers, etc.
  - 7. Miscellaneous hangers, supports, sleeves, inserts, isolators, flexible connections, seismic bracings, and other auxiliary equipment for all systems under this section.
  - 8. Equipment identification, operations and maintenance instructions.
- B. All apparatus, ductwork, etc. shall be installed and interconnected so as to form complete systems.
- C. Testing, adjustment and balancing of air systems.
- D. Duct leak test of all air systems.
- E. Measurement of final operating condition of HVAC Systems.
- F. Sound measurement of equipment operating conditions.

- G. Vibration measurement of equipment operation conditions.
- H. Provide two four-hour day of instructional time to Owner's maintenance of personnel by Contractor's start-up mechanic.
- I. All other work herein specified and shown on the accompanying drawings, including addendum, change orders and approved shop drawings.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Work designated on drawings to be installed or performed by other sections of the specifications.
- B. Motor starters shall be furnished and installed under Division 26 of the specifications, unless otherwise specified or shown. See equipment paragraphs, this section for packaged equipment to be furnished with starters.
- C. Finish painting of equipment, piping and ductwork shall be under Painting Section, except as noted otherwise.
- D. Equipment foundations, curbs or equipment pads as provided under the Concrete Section or Structural Steel Section. Coordinate exact foundation sizes and elevations and anchor bolt sizes and locations.

1.4 EQUIPMENT RESTRICTIONS

- A. Names of selected manufacturers have been specified for all items of equipment and materials. Bids shall be based on the use of the product of one of the selected manufacturers, and only such products may be submitted for approval.

1.5 SUBMITTALS

- A. In addition to the requirements of Section 23 05 00, the submittal brochures shall include the following items:

1. Air Distribution System:

- |                      |                        |
|----------------------|------------------------|
| Duct Sealer          | Diffusers              |
| Flexible Connections | Registers              |
| Flexible Duct        | Duct Access Doors      |
| Balancing Dampers    | Right Angle Extractors |
| Duct Turns           | Spin-In Fittings       |

2. Piping System:

- Condensate Drain Pipe Material and Fittings
- Pipe Hangers and Supports

3. Insulation:

- |           |                      |
|-----------|----------------------|
| Ductwork: | Piping:              |
| Interior  | Condensate Drain     |
| Exterior  | Insulation Jacketing |



Plenums  
Duct Liner

Accessories:

Pressure Gauges:

Thermometers:

Air

Air

4. Temperature Control Devices and Equipment

5. Equipment:

Airconditioning Unit

Unit Heaters

Exhaust Fans

Filters

Variable Speed Drives

Supply Fans

6. Shop Drawings:

- a. Dimension Drawings for concrete pad, curb and equipment foundation (1/4" scale minimum) including bolt sizes and locations.
- b. Submit fabrication details for equipment bases including dimensions, structural member sizes and support point locations. (1/4" scale minimum).
- c. Provide all details of suspension and support for ceiling hung equipment.
- d. Where walls, floors, slabs or supplementary steel work are used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers' submittals must include spacing, static loads and seismic loads at all attachment and support points.
- e. Provide seismic details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
- f. Control Wiring Diagrams.
- g. Provide complete scale (1/4" minimum) duct fabrication drawings for duct systems and equipment to be installed on this project to the Architect for approval prior to fabrication and installation.
  - (1) Duct offsets, transitions, sizes, routing and appurtenances shall be included in the scale drawings. Duct system installed locations shall be coordinated with Divisions of work included in this project prior to installation.
  - (2) The Mechanical Engineers Contract drawings shall not be used as the duct fabrication drawings. Drawings submitted in this

format will be rejected and returned not reviewed to the contractor for re-submittal.

- h. Submit fabrication details for equipment basis including dimensions, structural member sizes and support point locations. Provide all details of suspension and support for ceiling hung equipment. Where walls, floors, slabs or supplementary steel work is used for seismic restraint locations, details of acceptable attachment methods for ducts, conduit and pipe must be included and approved before the condition is accepted for installation. Restraint manufacturers submittals must include spacing, static loads and seismic loads at all attachment and support points. Provide specific details for seismic restraints and anchors; include number, size and locations for each piece of equipment.

7. Certified Report

- a. Airconditioning Unit

8. Air Balance Report Forms:

- a. Submit reports on AABC National Standards for Total System Balance or NEBB forms.

- b. Forms shall include the following information:

(1) Title Page:

- (a) Company name
- (b) Company address
- (c) Company telephone number
- (d) Project Name
- (e) Project Location
- (f) Project Architect
- (g) Project Engineer
- (h) Project Contractor
- (i) Project altitude

(2) Instrument List:

- (a) Instrument
- (b) Manufacturer
- (c) Model
- (d) Serial Number
- (e) Range
- (f) Calibration date

(3) Air Moving Equipment:

- (a) Location
- (b) Manufacturer
- (c) Model
- (d) Air flow, specified and actual return air flow, specified and actual

- (e) Outside air flow, specified and actual
  - (f) Total static pressure (total external), specified and actual
  - (g) Inlet pressure
  - (h) Discharge pressure
  - (i) Fan RPM
- (4) Exhaust Fan Data:
- (a) Location
  - (b) Manufacturer
  - (c) Model
  - (d) Air flow, specified and actual
  - (e) Total static pressure (total external), specified and actual
  - (f) Inlet pressure
  - (g) Discharge pressure
  - (h) Fan RPM
- (5) Supply Air/Return Air/Outside Air Data:
- (a) Identification/location
  - (b) Design air flow
  - (c) Actual air flow
  - (d) Design return air flow
  - (e) Actual return air flow
  - (f) Design outside air flow
  - (g) Actual outside air flow
  - (h) Supply air temperature
  - (i) Return air temperature
  - (j) Outside air temperature
  - (k) Required mixed air temperature
  - (l) Actual mixed air temperature
  - (m) Design outside/return air ratios
  - (n) Actual outside/return air ratios
- (6) Electric Motors:
- (a) Manufacturer
  - (b) HP/BHP
  - (c) Phase, voltage, amperage, nameplate, actual, no load
  - (d) RPM
  - (e) Service actor
  - (f) Starter size, rating, heater elements
- (7) V-Belt Drive:
- (a) Identification/location
  - (b) Required drive RPM
  - (c) Driven sheave, diameter and RPM
- (8) Air Distribution Test Sheet:
- (a) Air Inlet/Outlet number
  - (b) Room number/location
  - (c) Inlet/Outlet type

- (d) Inlet/Outlet size
- (e) Area factor
- (f) Design velocity
- (g) Design air flow
- (h) Test (final) velocity
- (i) Test (final) air flow
- (j) Percent of design air flow

(9) Cooling Coil Data:

- (a) Identification/number
- (b) Location
- (c) Service
- (d) Manufacturer
- (e) Air flow, design and actual
- (f) Entering air DB temperature, design and actual
- (g) Entering air WB temperature, design and actual
- (h) Leaving air DB temperature, design and actual
- (i) Leaving air WB temperature, design and actual
- (j) Air pressure drop, design and actual

(10) Heating Coil Data:

- (a) Identification/number
- (b) Location
- (c) Service
- (d) Manufacturer
- (e) Air flow, design and actual
- (f) Entering air temperature, design and actual
- (g) Leaving air temperature, design and actual
- (h) Air pressure drop, design and actual

(11) Sound Level Report:

- (a) Location
- (b) Octave bands – equipment off
- (c) Octave bands – equipment on

(12) Duct Leak Test:

- (a) Description of ductwork under test
- (b) Duct design operating pressure
- (c) Duct design test static pressure
- (d) Duct capacity, air flow
- (e) Maximum allowable leakage duct capacity times leak factors
- (f) Test apparatus:
  - i) Blower
  - ii) Orifice, tube size
  - iii) Orifice size
  - iv) Calibrated
- (g) Test static pressure
- (h) Test orifice differential pressure

(i) Leakage

c. Project Record Documents

(1) Accurately record actual locations of balancing valves and rough setting.

(2) Submit location chart.

## 1.6 CONCRETE WORK

A. All rough and finished concrete required for the installation of the work in this division shall be installed in accordance with the applicable portions of the Division 3 and Section 23 05 00 of these specifications.

B. Concrete Foundations: Contractor shall provide foundation bolts for the equipment furnished and shall coordinate the proper size concrete foundation and bolt location for foundations to be installed under the Concrete Section of the specifications. Submit shop drawing, drawn to scale, showing locations and dimensions of concrete foundations. Provide the following equipment:

1. Airconditioning Unit

## 1.7 VIBRATION ISOLATION

A. Vibration Isolators: Isolators shall have integral seismic restraints and be selected for minimum static deflection of 1 inch or as otherwise noted and in accordance with the equipment manufacturer's weight distribution so as to produce reasonable uniform deflection. Vibration isolators shall be a system by a manufacturer as listed by the Office of Statewide Health Planning Development (OSHPD); with an anchorage pre-approval R-number.

B. All mechanical equipment and ductwork shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonable uniform deflections.

C. All isolators and isolation materials shall be of the same manufacturer and shall be certified by the manufacturer.

D. It is the intent of the seismic portion of this specification to keep all mechanical building system components in place during a seismic event. All such systems must be installed in strict accordance with seismic codes, component manufacturers and building construction standards. Whenever a conflict occurs between the manufacturers or construction standards, the most stringent shall apply.

E. This specification is to be a minimum requirement for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state construction requirements (i.e., California Title 24, California OSHPD) or other requirements.

F. A variance or noncompliance with these specification requirements shall be corrected by the Contractor in an approved manner.

- G. Seismic restraint calculations must be provided for all connections of equipment to the structure. Calculations must be stamped by a registered professional engineer with at least five years of seismic design experience, licensed in the state of the job location.
- H. Calculations (including the combining of tensile and shear loadings) to support seismic restraint designs must be stamped by a registered professional engineer with at least five years of seismic design experience and licensed in the state of the job location. Testing and calculations must include both shear and tensile loads as well as one test or analysis at 45° to the weakest mode. Analysis must indicate calculated dead loads, static seismic loads and capacity of materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameters, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the forces acting through the equipment center of gravity. Overturning moments may exceed forces at ground level.
- I. Provide calculations to determine strain loads resulting from seismic forces presented in CBC 1632. Seismic calculations shall be certified by a licensed engineer, experienced in the design of restraints.
- J. Housekeeping pads shall be coordinated with a restraint vendor and sized to provide a minimum edge distance of ten (10) bolt diameters all around the outermost anchor bolt to allow development of full drill-in wedge anchor ratings. If cast-in anchors are to be used, the housekeeping pads shall be sized to accommodate the ACI requirements for bolt coverage and embedment.
- K. Constructor shall supply supplementary support steel for all equipment, piping, ductwork, etc., including the roof-mounted equipment as required.
- L. Contractor shall supply restraint attachment plates cast into housekeeping pads, concrete inserts, double-sided beam clamps, etc., in accordance with the requirements of the vibration vendor's calculations.
- M. Failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 inch and/or horizontal permanent deformation greater than 1/4 inch.

## **PART 2 - PRODUCTS**

### **2.1 VIBRATION ISOLATORS**

- A. Manufacturer based upon M.W. Saussé. Equal products by Mason Industries may be submitted for approval.
- B. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer. M.W. Saussé products are the basis of these specifications.
- C. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems.
- D. Seismic restraints for equipment shall be designed to meet the criteria established in the 2019 California Building.
- E. Vibration Isolator Types:

1. Type "RMS" shall be a laterally stable, unboxed spring isolator. Spring, top plate, and base plate assembly shall be welded.
2. Type "RMSG" shall be the same as "RMS" above, but shall include height saving brackets for attachment to the equipment frame or isolation base.
3. Type "RMSP-EQ" shall be the same as "RMS" above except that the spring shall be enclosed in a welded steel cylinder with uplift restraints for horizontal and vertical seismic control.
4. Type "RMLS-EQ" shall be the same as "RMS" above, and shall be equipped with a steel housing designed for seismic restraint and with vertical limit stops to prevent the equipment changing from its loaded height should it be necessary to remove a portion of its weight. This housing may also be used as rigid blocking during rigging so that the installed height and the operating height of the isolated equipment remain the same. O.S.H.P.D. pre-approval number OPA-0029.
5. Type "RMU-EQ-SH": shall be an individual semi-housed steel spring isolator complete with vertical motion limit stops incorporating seismic restraints, leveling, and ribbed neoprene pad bonded to the base plate. O.S.H.P.D. pre-approval number OPA-0098.
6. Type "RMXA" shall be a rectangular steel housing that shall be bolted to the overhead structure and designed to allow up to 30 degrees rod misalignment. Hanger shall consist of a steel spring located in a molded neoprene retaining cup with hanger rod bushing.
7. Type "PRMXA" - Same as type "RMXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.
8. Type "HXA" - Same as type "RMXA" with the addition of a neoprene element in series to isolate the upper connection.
9. Type "HSS" - shall be a rubber-in-shear isolator element contained within a rectangular steel housing.

F. Equipment Rails and Bases

1. Type "RMSBPI" shall be a steel frame inertia base with all welded members and constructed of structural channel shapes. The base shall be designed for a thickness or inertia mass to equipment weight ratio as shown on the schedule with a minimum thickness of six (6") inches. The bases shall include a template and anchor bolts to anchor the equipment. Inertia bases shall have 1/2" (#4) rebar spaced a maximum of 12" on centers in each direction and located 1-1/2" from the bottom of the base. Adjustable motor slide bases shall be included when required for centrifugal fan applications. Bases shall be supplied with height saving brackets to reduce the mounting height of the equipment.

G. Seismic Restraints

1. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration

isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Contractor shall submit calculations by a California registered engineer to verify snubber capacities.

2. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad. Restraints shall be O.S.H.P.D. pre-approved type OPA-0029.
3. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing. Restraints shall be O.S.H.P.D. pre-approved type OPA-0437.
4. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all load applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

## 2.2 DUCTWORK

### A. General

1. All ductwork shown on the drawings, unless otherwise indicated or specified shall be constructed of zinc-coated steel.
2. Minimum 24 gage galvanized steel sheets shall be first quality cold rolled, galvanized, open hearth soft steel sheets, capable of double seaming without fracture, meeting ASTM A525-87.
3. Aluminum sheets shall meet requirements of ASTM B209, 2, 1.4 mil finish.
4. Steel shapes shall be hot rolled, galvanized.
5. Screws and bolts shall be cadmium plated.
6. Materials and construction shall be in accordance with tables listed in SMACNA HVAC Duct Construction Standards and California Code of Regulations (Title 24, Part 4). The most stringent of the SMACNA Standards or the California Code of Regulations, shall be applicable.
7. Pressure: Unless otherwise indicated, all ductwork shall be constructed for 2" pressure class.

### B. Materials, Application

1. Pressure: Unless otherwise indicated, all ductwork shall be constructed for 2" pressure class. Materials and construction shall be in accordance with tables listed in SMACNA HVAC Duct Construction Standards and International Code of



Regulations. The most stringent of the SMACNA Standards or the International Code of Regulations, shall be applicable.

2. Ducts shall be sealed to SMACNA seal class "A", UL 555. No duct tape shall be permitted.
3. Transverse joints in rectangular ducts may be manufactured type similar to Ductmate Industries, Inc.

C. Special Exhaust Systems:

1. Ducts connected to vehicle exhaust systems shall be welded and constructed with No. 304 stainless steel 16 gage material.

D. Circular Ducts

1. Circular (cross section) sheets shall be galvanized steel of spiral seam construction.
2. Joints between two ducts shall be made with beaded sleeve joint having duct sealer applied to joint. Mechanically fasten joints with sheet metal screws or pop rivets.
3. The radius of elbows shall be minimum of 150% of the diameter or maximum width of duct. Gored elbows are not acceptable.
4. The fittings shall be of conical type change in shape from round to rectangular mode with transformation joint with minimum of 1 to 7 taper.
5. Corrugated or flexible metal duct circular ducts will not be acceptable.

E. Spin-In Fittings

1. For all round duct takeoff from a rectangular duct shall be constructed of galvanized steel complete with angled, scoop extractor and spring-loaded locking quadrant butterfly damper. Damper shall be a factory installed with spring loaded retractable bearing. Mounting groove shall be a die formed. Install using duct sealer at tap-in to a main duct.

F. Duct Supports

1. Duct hangers, spacing of hangers, upper and lower attachments, etc. shall conform to the most stringent requirements of the SMACNA or Uniform Mechanical Code. See Part 3.0 for seismic requirements.
2. Provide additional supports for upper attachments for ductwork utilizing a secondary steel support system consisting of roll-formed channel, "Unistrut" Series P-1002 (back-to-back 1-5/8" X 0.010") roll formed channels) members securely attached between support beams or purlins in accordance with structural engineer's approval. Attach duct mounting straps to steel channels using "Unistrut" type spring-loaded, matching nuts and bolts. Furnish additional "Unistrut" channel, clamps, brackets, etc., for complete support of ductwork and diffusers. Do not penetrate a metal duct with any fasteners.

G. Access Doors

1. Manufacturer based upon Ventfabrics. Equal products by DuroDyne may be submitted for approval.
2. Non-walk-in access doors for circular ducts shall conform to SMACNA Duct Construction Standards, Figure 2-11 and accompanying description, except other items shall be the same as for rectangular ducts.
3. Non-walk-in access doors in rectangular sheet metal ducts shall conform to SMACNA Duct Construction Standards, Fig. 2-10, plus accompanying description, except that the following shall be provided:
  - a. Latch: Ventfabrics model 140 with stud long enough to accommodate a door up to 2" thick. Complete with steel and sponge rubber washer.
  - b. Hinge: Use two hinges on doors where the hinged edge is less than 24", three hinges on doors where the hinged edge is 24" and over. Doors under 14" x 14" size shall be No. 24 gauge with piano hinge and edge stiffeners.
  - c. Door Thickness: All doors shall be double thickness. Provide full thickness of insulation inside door panels in insulated ducts.
  - d. Gasketing: The door shall have a compressible gasket seal of incombustible material.
  - e. Dimensions: Minimum 12" X 12" in furred spaces and 18" X 18" in equipment rooms.

H. Flexible Duct

1. Manufacturer based upon Casco model Silent Flex II. Equal products by Thermaflex may be submitted for approval.
2. General: Insulated flexible ductwork shall be a factory fabricated assembly composed of a high carbon spring steel wire with a non-corrosive zinc coating spiral helix permanently bounded to a spun bonded non-woven nylon interior liner, and supporting a fiberglass insulating blanket with a polyethylene jacket vapor barrier. Working pressure: Plus 1-1/2" W.G. minimum.
3. Length of flex ducts shall be 6'-0" maximum. Suspend at maximum 3'-0" O.C. with 1-1/2" wide galvanized sheet metal straps.
4. Ductwork shall have precut lengths with continuous inner liner.
5. Round duct takeoffs from main ducts shall be provided with "Spin-In" or "Twist-Lok" fittings and a factory installed manual balancing damper assembly complete with a level position indicator and a positive locking device.
6. The flexible duct shall be listed in accordance with UL 181, Class 1 flexible air duct requirements and comply with NFPA 90A and 90B with a flame and smoke spread rating not in excess of 25/50.

7. Insulation must achieve a minimal thermal R-value rating of 4.2 and must be completely shielded from the airstream at all times.

I. Dampers

1. Manufacturer based upon Pottorff model CD-10 and CD-10R. Equal products by Ruskin or Ventfabrics may be submitted for approval.
2. Manual volume dampers in ducts up to 48" in width shall conform to SMACNA Duct Construction Standards Fig. 2-12 or 2-13 plus its accompanying description except that the following shall be provided:
  - a. The gauge of leaf shall be equal to that of the duct in which the damper is located, except that it shall never be less than 22 gauge. Fasten damper leaves to square rods using damper blade clips. Blade shaft shall be 3/8" square, zinc plated with tight sealing nylon bushings. Damper leaves shall not exceed 8" in width. Use multiple leaves when required. All dampers shall be stiffened where necessary to prevent noise. Any damper causing any noise shall be replaced by new ones or additional stiffeners added so as to eliminate the noise.
3. All steel parts shall be galvanized.
4. For insulated ductwork, the operator arm shall be set on an extension bracket flush with the outside of the insulation. Notch all damper rod ends to indicate position of installed damper blades.
5. All volume dampers above suspended ceilings shall be marked by attaching a 12" length strip of bright yellow cloth to the damper rods.

J. Backdraft Dampers

1. Manufacturer based upon Pottorff model BD64. Equal products by Ruskin or Ventfabrics may be submitted for approval.
2. Backdraft damper shall be low-leakage type with aluminum blades with neoprene blade seals mounted in a 12-gauge minimum steel frame. Bearings shall be oil-impregnated bronze, Teflon or nylon sleeve type. The steel frame shall be a factory finished with a mill galvanized finish.

K. Damper Regulator Hardware

1. Manufacturer based upon Ventfabrics. Equal products by Durodyne may be submitted for approval.
2. For accessible locations in low pressure ducts, provide each leaf with No. 607 end bearing and No. 640 or No. 641 self-locking regulator.

L. Damper Regulator Hardware (Concealed for hard ceiling and inaccessible ceiling area)

1. Manufacturer based upon Young Regulator model 270-301. Equal products by Ventfabrics or Pottorff may be submitted for approval.

2. Damper controller and cable shall be concealed above the ceiling. Cable consists of a Bowden cable 0.054" stainless steel control wire encapsulated in 1/16" flexible galvanized spiral wire sheath. Control kit shall consist of 2-5/8" diameter die cast aluminum housing with 3" diameter zinc plated cover, and 14 gauge steel rack and pinion gear drive converting rotary motion to push-pull motion. Control shaft shall be D-style flatted 1/4" diameter with 265-degree rotation providing graduations for positive locking and control, and 1-1/2" linear travel capacity. Control kit is designed to be imbedded in the ceiling flush with the finished surface. Control kit shall be manual operated using model 030-12 wrench.

M. Louvers

1. Manufacturer based upon Ruskin ELF375DX. Equal products by Greenheck or Pottorff may be submitted for approval.
2. Louvers shall be stationary type with downspouts in jams and mullions. Louver shall have a minimum of 52% free area. Blades and frame shall be extruded 6063T5 aluminum alloy.
3. Provide birdscreen.
4. Finish shall be prime coat ready for field painting.

N. Louvers (Round)

1. Manufacturer based upon Ruskin model ELR. Equal products by Greenheck or Pottorff may be submitted for approval.
2. Louvers shall be stationary type with frame of extruded 6063T5 aluminum alloy. Blades shall be style ELF375X of 6063T5 extruded aluminum. Louver shall have a minimum of 55% free area.
3. Provide birdscreen.
4. Finish shall be prime coat ready for field painting.

O. Relief Doors

1. Manufacturer based upon Pottorff model NPR-BI for negative pressure and model PPR-BO for positive pressure. Equal products by Ruskin may be submitted for approval.
2. Relief doors shall be constructed utilizing 12 gage, galvanized steel, for frame and doors. Door seals shall be sealed with 1/4" thick compressible noncombustible gasket (minimum). Door seals shall have field adjustable door release mechanisms with coiled springs to automatically return the door to closed position when pressure is relieved. Mount in vertical position only. Use high pressure sealing cement and screws.

P. Flexible Connectors

1. Manufacturer based upon Ventfabrics. Equal products by DuroDyne may be submitted for approval.
2. Provide where called for on drawings and at the ducted discharge and ducted inlet of every fan.
3. Indoor Applications
  - a. Heavy glass fabric with double-coated with polychloroprene with resistance to abrasion and damage from flexing. Complies with UL #214 and NFPA 90A.
  - b. Model Ventglas
4. Outdoor Applications
  - a. Heavy glass fabric with double-coated chlorosulfurated polyethylene. Resistant to sunlight, ozone, and weather. Complies with UL #214 and NFPA 90A.
  - b. Model Ventlon

Q. Duct Sealer

1. Manufacturer based upon Casco. Equal products by United Duct Sealer may be submitted for approval.
2. Duct sealer shall be UL Classified, water based, fire resistive, indoor/outdoor, permanently flexible.
3. Duct tape is unacceptable.

R. Instrument Test Holes

1. Manufacturer based upon Ventfabrics model 699. Equal products by Durodyne may be submitted for approval.
2. Test hole shall provide opening for Pitot tubes and other test instruments. The hole is sealed off with a heavy screw cap and gasket. Provide special gasket to adapt test hole to round duct. Height of test hole shall accommodate height of duct insulation.
3. Provide test holes in Airconditioning Units supplying in both horizontal and vertical positions at the following locations:
  - a. Supply air ducts at each air-conditioning unit.
  - b. Return air duct at each air-conditioning unit.
  - c. Fresh air duct at each air-conditioning unit.
  - d. Exhaust air duct at each exhaust fan.

e. Supply air duct at each supply fan.

S. Filter Pressure Gauges

1. Manufacturer based upon Dwyer model Magnahelic Series 2000. Campus standard, no equal.
2. Pressure limits of 0-20" w.g., diaphragm actuated, 4" diameter dial face, +/-2% accuracy of full scale, zero pointer adjustment.
3. Furnish with two static pressure tips, fittings for ¼" metal tubing, and mounting kit.
4. Provide a differential pressure gauge at each air handling unit filter bank with separate gauges to read pressure drop across each type of filter. Mount gauges at eye level with brackets attached to air handling unit. Provide engraved name tag for filter as specified above.

2.3 PIPING

A. Condensate

1. Copper
  - a. Pipe: ASTM B88, type L hard drawn, seamless copper pipe.
  - b. Fittings: ANSI/ASME B16.22 wrought copper.
  - c. Joints: lead free, tin silver 95-5 alloy solder. Use silver solder joint ANSI 150 lb. for flanges.

B. Flexible Piping Connector.

1. Manufacturer based upon M.W. Sausse. Equal products by Mason may be submitted for approval.
2. Wire braded covered annular corrugated hose of stainless steel.

2.4 INSULATION

A. All pipe fittings and valves and duct thickness shall conform to Title 24 as a minimum. Use thickness specified, if greater than Title 24 requirements. All insulation to have a flame spread of not more than 25 and a smoke density not exceeding 50 when tested as a composite.

B. Pipe

1. Manufacturer based upon Johns Manville. Equal products by Knauf or Owens Corning may be submitted for approval.
2. Micro-Lok
  - a. Rigid molded fiber glass pipe insulation meeting ASTM C 547.

- b. Chilled water thermal conductivity ("k") value of 0.23 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
- c. Heating hot water thermal conductivity ("k") value of 0.29 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 200°F.
- d. Maximum service temperature of 850°F.
- e. Provide vapor retarder jacket AP-T PLUS white kraft paper of reinforced with glass fiber yarn and bonded to aluminum foil, secures with self sealing longitudinal laps and butt strips or AP jacket with outward clinch expanding staples or vapor barrier mastic as needed.

3. Field Applied Jackets:

- a. Aluminum Jacket: 0.020 inches thick sheet, smooth/embossed finish with longitudinal slip joints and 2 inches laps, die shaped fitting covers with factory attached protective liner.

C. Equipment

- 1. Manufacturer based upon Johns Manville. Equal products by Knauf or Owens Corning may be submitted for approval.

2. 812 Series Spin-Glas:

- a. Flexible equipment insulation meeting ASTM C 533, Type III.
- b. Thermal conductivity ("k") value of 0.24 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
- c. Maximum service temperature of 450°F.
- d. Density shall equal 1.50 lb / ft<sup>3</sup>
- e. Provide aluminum foil reinforced with fiber glass yarn and laminated with fire-resistive adhesive to kraft paper (FSK Reinforced Foil and Paper). Secure with UL listed pressure sensitive tape and / or outward clinch expanding staples and vapor barrier mastic.

3. 814 Series Spin-Glas:

- a. Rigid equipment insulation meeting ASTM C 612, Type IA and IB.
- b. Thermal conductivity ("k") value of 0.23 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
- c. Maximum service temperature of 450°F.
- d. Density shall equal 3.00 lb / ft<sup>3</sup>
- e. Provide aluminum foil reinforced with fiber glass yarn and laminated with fire-resistive adhesive to kraft paper (FSK Reinforced Foil and Paper). Secure with UL listed pressure sensitive tape and / or outward clinch expanding staples and vapor barrier mastic.

4. Thermo-12 Gold:
  - a. Rigid molded hydrous calcium silicate meeting ASTM C 533, Type I.
  - b. Insulation shall be asbestos free coded throughout material thickness and maintained throughout temperature range.
  - c. Heating hot water thermal conductivity ("k") value of 0.45 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 300°F.
  - d. Maximum service temperature of 1200°F.
  - e. Compressive Strength (block): Minimum of 200 psi to produce 5% compression at 1-1/2" thickness.
  - f. Noncombustible as per ASTM E136 test.

D. Ductwork

1. Manufacturer based upon Johns Manville. Equal products by Knauf or Owens Corning may be submitted for approval.
2. Flexible Duct Wrap
  - a. MircoliteType 75.
  - b. Flexible fiber glass blanket meeting ASTM C553.
  - c. Thermal conductivity ("k") value of 0.27 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
  - d. Density shall equal 0.75 lb / ft<sup>3</sup>
  - e. Provide aluminum foil reinforced with fiberglass yarn and laminated with fire-resistive adhesive to kraft paper (FSK Reinforced Foil and Paper). Secure with UL listed pressure sensitive tape and / or outward clinch expanding staples and vapor barrier mastic.
3. Duct Acoustical Lining (Rectangular)
  - a. Permacote Linacoustic.
  - b. Rectangular duct liner meeting ASTM C1071 with air surface coated with acrylic coating treated with EPA registered anti-microbial agent proven to resist microbial growth as determined by ASTM G 21 and G 22.
  - c. Thermal conductivity ("k") value of 0.25 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
  - d. Noise reduction coefficient of 0.70 or higher based upon Type A mounting and testing in accordance to ASTM C423.
  - e. Maximum velocity of 5,000 ft / min.
  - f. Adhesive shall meet ASTM C916.



- g. Fasteners shall be duct liner galvanized steel pins, welded or mechanically fastened.
4. Duct Acoustical Lining (Round)
- a. Permacote Spiracoustic.
  - b. Round duct liner with air surface coated with acrylic coating treated with EPA register anti-microbial agent proven to resist microbial growth as determined by ASTM G21 and G22.
  - c. Thermal conductivity (“k”) value of 0.23 Btu\*in/(hr\*ft<sup>2</sup>\*°F) at 75°F.
  - d. Noise reduction coefficient of 0.70 or higher based upon Type A mounting and testing in accordance to ASTM C423.
  - e. Maximum velocity of 5,000 ft / min.

5. Pipe Insulation Schedule:

a. Fiber Glass Insulation:	Pipe Size Inch	Thickness Inch
(1) Condensate Drain	all sizes	1

E. Ductwork Insulation Schedule:

1. Flexible Fiber Glass	Thickness Inch	Finish
a. Exhaust Ducts within 10 ft. of Exterior Openings	1-1/2	FSK
b. Exhaust Ducts Exposed to Outdoor Air Ventilation Casings	1/1/2	FSK
c. Air Ventilation Equipment Casings	1-1/2	FSK
d. Supply Ducts (Cooling System) & Sound Traps	1-1/2	FSK
e. Return Ducts & Sound Traps in Unconditioned Spaces and in space above ceilings	1-1/2	FSK
2. Rigid Fiber Glass		
a. Combustion Air Ducts	3	AP
b. Outside Air Intake Ducts	2	FSK

c.	Plenums (Cooling Systems)	2	FSK
d.	Ducts Located Outside	2	FSK
3.	Duct Liner		
a.	Where indicated and 20'-0" minimum from air-conditioning unit intake and discharge	1	Linacoustic or Permacote
b.	Supply and Return Ducts located outdoors	2	Linacoustic or Permacote

## 2.5 DIFFUSERS, REGISTERS, GRILLES

### A. Diffusers, Registers, Grilles

1. Manufacturer based upon Krueger. Equal products by Anemostat or Price may be submitted for approval.
2. Diffuser, register, and grille sizes are indicated on drawings.

### B. Diffusers (Krueger model 1240PE):

1. Modular snap-in cores, perforated, for mounting in 24-inch x 24-inch lay-in tee grid ceiling suspension system or for surface mounting. Steel construction. Provide a round neck adaptor.

### C. Return and Exhaust Air Registers (Krueger model 6590):

1. Perforated face type of steel construction. The frame shall be nominal 24" x 24" for mounting in 24" x 24" lay-in tee grid ceiling suspension system. For hard ceilings, provide return and exhaust air registers of neck size.

### D. Sidewall Supply Registers (Krueger model 880H):

1. Double deflection supply grille. Deflection vanes spaced on 3/4" centers. Steel construction. Frame for surface mounting to wall. Provide opposed blade damper.

### E. Sidewall Return Registers (Krueger model S85H):

1. Single deflection return register. Fixed deflectors spaced on 1/2" centers set at 35°. Steel construction. Frame for surface mounting to wall. Provide opposed blade damper.

- F. Submit one sample of each type, tagged for identification to the Architect for approval. Install one of each type and obtain written approval from Architect prior to ordering.

- G. All sheet metal duct collars or plenum boxes for diffusers and registers shall be painted black prior to installation of the diffuser and register. Unless otherwise noted, all diffusers and registers shall be furnished with off-white baked enamel finish. After balancing and testing, the Contractor shall refinish all damaged spots and screw heads.

## 2.6 DUCT SMOKE DETECTORS

- A. Duct Smoke detectors are provided and wired under Division 16 contract and installed by Division 23 contractor.
- B. Refer to Division 26 and 27 for the product specification.

## 2.7 EXHAUST FANS AND SUPPLY FANS

- A. Centrifugal Square Inline Exhaust Fans and Supply Fans
  1. Manufacturer based upon Cook Model SQN-B. Equal products by Greenheck may be submitted for approval.
  2. Description: Fan shall be duct mounted, belt driven centrifugal square inline.
  3. Certifications: Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.
  4. Construction: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.
  5. Wheel: Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
  6. Motor: Motor shall be NEMA design B with class B insulation rated for continuous duty and furnished at the specified voltage, phase and enclosure.
  7. Bearings: Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.
  8. Belts and Drives: Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely

attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

9. Cook Variable Speed Drive shall be mounted on the Fan for speed/CFM control.

B. Ceiling Inline Centrifugal Exhaust Fans

1. Manufacturer based upon Cook Model GN 1000 or GN 2000 Series. Equal products by Greenheck may be submitted for approval.
2. Description: Fan shall be ceiling inline mounted, direct driven, centrifugal exhaust fan.
3. Certifications: Fan shall be manufactured by an ISO 9001 certified company. Fan shall be listed by Underwriters Laboratories (UL 705). Fan shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.
4. Construction: The fan housing shall be minimum 20 gauge galvanized steel and acoustically insulated. Blower and motor assembly shall be mounted to a minimum 14 gauge reinforcing channel. Motor shall be resiliently mounted. Unit shall be supplied with integral wiring box. Discharge position shall be field convertible from straight through, inline configuration to right angle configuration by moving interchangeable panels. The outlet duct collar shall include reinforced aluminum dampers with continuous aluminum hinge rods and brass bushings. To accommodate different ceiling thickness, an adjustable prepunched mounting bracket shall be provided. Unit shall be shipped in ISTA Certified Transit Tested Packaging.
5. Wheel: Wheels shall be twin DWDI centrifugal forward curved type, constructed of galvanized steel. Wheel shall be balanced in accordance with AMCA Standard 204-05, Balance Quality and Vibration Levels for Fans.
6. Motor: Motor shall be totally enclosed type with permanently lubricated bearings and built-in thermal overload protection. Motor shall be furnished at the specified voltage and phase.

2.8 VARIABLE FREQUENCY DRIVES

- A. Manufacturer based upon ABB model series ACH-550. Campus standard, no equal.

B. General

1. This specification covers a complete adjustable frequency motor drive consisting of a Pulse Width Modulated (PWM) inverter for use on a standard NEMA Design B induction motor. The drive shall have external surge protector, option pack, external fault input to provide indication of fire or smoke detection activation, door mounted analog meters (volts, amps, speed). Scale on the ammeter shall have a range that places the motor full load amps at approximately mid scale. All factory options shall be installed at the factory, less remote keypad and pressure transducers.
2. The variable frequency drive (VFD) shall be solid state with Pulse Width Modulated (PWM) output waveform. VFD's with obsolete designs (VVI, six-step

and current source) are not acceptable. The VFD as specified herein shall be enclosed in a NEMA 1 enclosure and be completely factory assembled and tested by the manufacturer for installation on the fan section. The VFD shall employ a full wave rectifier (to prevent input line notching), the DC bus choke, DC bus filter capacitors and uses the newer insulated Gate Biopolar Transistors technology as the output switching device VFD with (SCR's, GTO's and Darlingon Transistors) are not acceptable. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.

3. The VFD manufacturer shall provide estimated line distortion percentages in accordance with IEEE STD-519, 1992, based upon the total connected horsepower and source KVA of power of the distribution system.
4. All printed circuit boards shall be completely tested and burned in before being assembled into the completed VFD. The VFD shall then be subjected to a preliminary functional test, eight hour burn-in and computerized final test. The burn-in shall be at 104 degrees F (40 degrees C), at full rated load or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation.
5. VFD shall be UL listed. The VFD shall be designed to meet the requirements of the following standards: IEC 801-2, IEC 801-4 and IEC 255-4.

C. Frequency Control Specifications

1. VFD input voltage shall be adjustable at 440/460/480/500 VAC, 3 phase, 48 – 63 Hertz to meet the actual line voltage at the site. Voltage tolerance shall be 500 VAC + 10% (550) and 440 VAC – 10% (396).
2. Environmental operating conditions shall be 0°C to 40°C, 0 to 3300 feet above sea level, less than 95% humidity and non-condensing.
3. All VFD's shall have the following standard features:
  - a. For parts interchangeability purposes, all VFD's at the jobsite shall have the same customer interface including digital display, keypad and customer connections; regardless of horsepower rating. The keypad shall be used for local control (start/stop, forward/reverse and speed adjust) for setting all parameters and for stepping through the displays and menus.
  - b. The VFD shall give the user the option of either displaying a fault or running at a programmable preset speed if the input reference (4-20mA or 2-10V) is lost; as selected by the user.
  - c. The VFD shall utilize plain English digital display (code numbers are not acceptable). The digital display shall be a 40 character (2 line x 20 characters/line) LCD display. The LCD shall be backlit to provide easy viewing in any light condition. The contrast should be adjustable to optimize viewing at any angle. All set-up parameters, indication, faults, warning and other information must be displayed in words to allow the user to understand what is being displayed without the use of a manual or cross-reference table.

- d. The VFD shall utilize pre-programmed application macros specifically designed to facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.
- e. The VFD shall have the ability to automatically restart after an over current, over voltage, under voltage or loss of input signal protective trip. The number of restart attempts and trial time shall be programmable.
- f. The VFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to set point without safety tripping or component damage (flying start). The VFD that must coast to stop before restart will not be acceptable.
- g. The VFD shall be equipped with an automatic extended power loss or ride-through circuit which will utilize the inertia of the load to keep the drive powered.
- h. Minimum power loss ride-through shall be one-cycle, based on full load and no inertia. Removing power from the motor is not an acceptable method of increasing power loss ride-through.
- i. The customer terminal strip shall be isolated from the line and ground.
- j. Prewired 3-position Hand-Off-Auto switch and speed potentiometer shall be included. When the switch is in the "Hand" position, the VFD will be started and the speed can be controlled from the speed potentiometer. When in the "Off" the VFD will be stopped. When in the "Auto" position, the VFD will start via an external contact closure and its speed will be controlled via an external speed reference.
- k. The drive shall employ three current limit circuits to provide trip free operation:
  - (1) The Slow Current Regulation limit circuit shall be adjustable from 50% to 110% of the VFD's variable torque current rating. This adjustment shall be made via the keypad and shall be displayed in actual amps, not as percent of full load.
  - (2) The Rapid Current Regulation limit shall be fixed at 145% of the VFD's variable torque current rating.
  - (3) The Current Switch-Off limit shall be fixed at 150% of the VFD's variable torque current rating.
- l. The overload rating of the drive shall be 110% of its variable torque current rating for 1 minute every 10 minutes and 115% of its variable torque current rating for 2 seconds every 10 seconds.
- m. The VFD shall have input line fuses standard in the drive enclosure.
- n. The VFD shall have a manual speed potentiometer in addition to using the keypad as a means of controlling speed manually.

4. Required Frequency Control Adjustments:
  - a. Five (5) programmable critical frequency lockout ranges to prevent the VFD from continuously operating at an unstable speed.
  - b. P1 Set point controller shall be standard in the VFD allowing a pressure or flow signal to be connected to the VFD. The microprocessor in the VFD shall be used for the closed loop control; eliminating the need for external controllers.
  - c. Two (2) programmable analog inputs shall accept a current or voltage signal for speed reference, or for reference and actual signals for P1 controller. Analog inputs shall include a filter, programmable from 0.01 to 10 seconds to remove any oscillation in the input signal. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0-20 mA and 0-10 volts.
  - d. Six (6) programmable digital inputs for maximum flexibility in interfacing with energy management systems.
  - e. Two (2) programmable analog outputs proportional to Frequency, Motor Speed, Output Voltage, Output Current, Motor Power or DC Bus Voltage.
  - f. Three (3) programmable digital relay outputs.
  - g. The relays shall be rated for maximum switching current 8 amps at 24 VDC and 0.4 amps at 250 VAC.
  - h. Maximum voltage 300 VDC and 250 VAC.
  - i. Continuous current rating 2 amps RMS.
  - j. Seven (7) programmable preset speeds shall be provided.
  - k. Two independently adjustable accel and decel ramps. These ramp times shall be adjustable from 1 to 1800 seconds.
  - l. The VFD shall Ramp or Coast to a stop, as selected by the user.
5. Required Operating Information Displays:
  - a. The Following operating information displays shall be standard on the VFD digital display. The display shall be in complete English words (alpha-numeric codes are not acceptable):
    - (1) Output Frequency
    - (2) Motor Speed (RPM)
    - (3) Motor Current
    - (4) Calculated Motor Power

- (5) DC Bus Voltage
- (6) Output Voltage
- (7) Heatsink Temperature
- (8) Analog Input Values
- (9) Keypad Reference Values
- (10) Elapsed Time Meter
- (11) kWh Meter

6. Required Protection Circuits:

- a. The VFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop and announce the fault condition in complete words (alpha-numeric codes are not acceptable).
- b. Over current trip 200% of the VFD's variable torque current rating.
- c. Over voltage trip 130% of the VFD's rated voltage.
- d. Under voltage trip 60% of the VFD's rated voltage.
- e. Ground Fault.
- f. Adaptable Electronic Motor Overload (I-t).
- g. The Electronic Motor Overload protection shall protect the motor based on speed, load curve and external fan/pump parameter. Circuits which protect the motor only at full speed are unacceptable).

7. Required Speed Command Inputs Available:

- a. Keypad or manual speed potentiometer; as selected by the user.
- b. Two Analog inputs, each capable of accepting a 0-2mA, 0-10V, 2-10V signal. Input shall be isolated from ground and programmable via the keypad for different uses.
- c. Analog inputs shall have a programmable filter to remove any oscillation of the reference signal. The filter shall be adjustable from 0.01 to 10 seconds.
- d. The analog inputs shall be able to be inverted, so that minimum reference corresponds to maximum speed, and maximum, reference corresponds to minimum speed. The minimum and maximum values (gain and offset) shall be adjustable within the range of 0-20 mA and 0-10 Volts.
- e. P1 set point control shall be included.



8. Factory Mounted Frequency Control Accessories:
  - a. Manual or automatic transfer to across-the-line, line power via electric contractors:
  - b. All three-position selector switch to control the bypass contractor and the drive output contractor is to be mounted on the enclosure door. When in the "Normal" mode, the bypass contractor is open and the drive output contactor is closed. In the "Test" position both conductors are open, and in the "Bypass" position, the drive output contactor is open and the bypass contactor is closed. The drive output contactor shall also open when a stop command is given, isolating the motor from the drive. Bypass shall electrically isolate the drive from the line.
  - c. Motor thermal overload and fuse or circuit breaker protection shall be provided while in bypass operation.
  - d. Start/stop signals and safety interlocks shall work in drive and bypass modes.
  - e. Class 20 bimetallic thermal motor overload relays shall be provided for each motor when the VFD is applied to more than one motor for protection while the motors are in bypass.
  - f. A line reactor shall be provided when the wire length between the VFD and the motor exceeds 175 feet. The line reactor shall be factory mounted and wired in the bypass cabinet.
9. Required Compliance to IEEE 519-1992:
  - a. The VFD manufacturer shall provide calculation, specific to this installation, showing total harmonic voltage distortion per IEEE Standard 519-1992, "Guide for Harmonic Control and Reactive Compensation for Static Power Converters." The acceptance of this calculation must be completed prior to VFD installation.
  - b. Prior to installation, the VFD manufacturer shall provide the estimated Total Harmonic Distortion (THD) caused by the VFD. The results shall be based on a computer aided circuit simulation of the total actual system with information obtained from the power provider and the user.
  - c. If the voltage THD exceeds 3%, the VFD manufacturer is to recommend the additional equipment required to reduce the THD to an acceptable level of less than 3% THD. Individual or simultaneous operation of the VFD's shall not add more than 3% total harmonic voltage distortion. Maximum allowable total and individual harmonic current distortion limits for each odd harmonic shall not exceed limits as set forth by IEEE 519, 1992. If harmonic filters are required to meet these requirements, the VFD manufacturer must provide the filter and is responsible for the design and manufacturing of the filter. A preliminary harmonic analysis, which includes all harmonics to the 99<sup>th</sup>, must be submitted by the VFD manufacturer with onsite field measurements of the harmonic distortion at the point of common coupling with and without VFD's operating.

Manufacturers shall certify at submittal time that their equipment will function satisfactorily under the specified criteria.

10. Start-Up, Training, Warranty and Emergency Service
  - a. Certified factory start-up shall be provided for each variable speed drive by authorized service personnel. A start-up form shall be completed for each drive. A copy shall be provided to Owner.
  - b. Training of Owner Operating and Maintenance Personnel shall be provided during one (1) eight hour day. The training shall be scheduled during start-up with the control contractor in attendance.
  - c. Warranty shall be 24 months from the date of start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses.
  - d. The manufacturer shall have an existing sales, service and parts supplied network local to the installation site.
11. Emergency Service: Owner will initiate service calls when the drive is not functioning properly. Qualified personnel shall be available to provide service to the drive. Furnish Owner with a telephone number, attached to each drive, where service representative can be reached at all times. Service personnel shall be at the site within 24 hours after receiving a request for service. Replace with new or restore the drive to proper operating conditions within three (3) days.

## 2.9 PACKAGED AIR CONDITIONING UNITS (FUTURE)

- A. Manufacturer based upon Trane or equal by Carrier.
- B. Unit Casing
  1. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.
  2. Units cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
  3. Cabinet top cover shall be one piece construction or where seams exists, it shall be double-hemmed and gasket-sealed.
  4. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan Units base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
  5. Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.

6. Provide openings either on side of unit or through the base for power, control, condensate, and gas connections.

C. Air Filters

1. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. One-inch thick glass fiber disposable media filters shall be provided with the provisions within the unit for Merv 15 two inch thick filters to be field- provided and installed.

D. Fans and Motors

1. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
2. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
3. Provide units 5 tons and below with direct drive, multiple speed, dynamically balanced supply fans.
4. Provide units 6 tons and above with belt driven, supply fans with adjustable motor sheaves.
5. Outdoor and Indoor Fan shall be permanently lubricated and have internal thermal overload protection.
6. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
7. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

E. Gas Fired Heating Section

1. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided. Provide capability for gas piping.
2. Induced draft combustion type with direct spark ignition system, redundant main gas valve, and 2-staged heat.
3. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.
4. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.
5. Heat Exchanger: Provide tubular section type constructed from 18-gauge aluminized steel.

6. Limit controls: High temperature limit controls will shut off gas flow in the event of excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.
- F. Evaporator Coil
1. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.
  2. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
  3. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.
- G. Condenser Section
1. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.
- H. Refrigeration System
1. Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.
  2. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
  3. Provide each unit with refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.
- I. Barometric Relief Economizer
1. Provide barometric relief damper in the economizer with motorized outside air damper and motorized return air damper.
- J. Operating Controls
1. Provide microprocessor unit-mounted BACnet DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.
  2. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
  3. Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.

4. Economizer Preferred Cooling (supplied with barometric relief economizer) - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

## 2.10 GAS UNIT HEATERS

- A. Manufacturer based upon Trane or equal by Reznor or Modine.
- B. Units
  1. Unit shall be factory-assembled, piped, wired and test fired. The Unit shall include supply fan, heat exchanger, burners, 115 to 24V control transformer, horizontal louvers, special orifices for high altitude applications, starter/contacter, controls: high limit temperature switch, ignition controls, 460/115V and 120V/24 transformers, etc., combustion air intake duct and flue vent with roof penetration and rain cap.
  2. Unit shall be certified, conform with the latest ANSI standards and comply with 2019 California Energy Code/title 24.
  3. Unit shall be provided with two point suspension.
  4. Unit 115 volt wiring shall be in flexible conduit.
- C. Performance Ratings
  1. Units shall have at least an 80% Thermal efficiency rating.
- D. Air Handling
  1. Fans shall be propeller type with steel hubs and aluminum blades.
  2. Fan shall be provided with a 100% fan guard. OSHA Fan Guards, shall be provided.
  3. Motors shall be 115V single phase, 60 Hertz current. Motors shall be with built-in thermal overload protection.
- E. Casing shall be die-formed, 20 gauge galvanized steel and finished in baked enamel. The bottom panel shall be easily removed to provide service access to the burners, pilot and orifices. The pilot shall also be accessible through a side panel access plate.
- F. Heat Exchanger shall consist of tube sections not lighter than 20 gauge and connecting plates not lighter than 18 gauge. Heat exchanger shall be 100% welded. Material shall be aluminized steel and shall be equipped with a stainless steel burner shade.
- G. Tubular Heat Exchanger shall be supplied on propeller style models, and shall consist of 20-gauge aluminized steel of curved, non-welded serpentine design. This shall be equipped with a hot surface pilot ignition, constructed of shock resistant ceramic

composite hot surface element. This design shall experience less thermally induced stress making it highly durable for longer service life.

- H. Casing shall be die-formed, 20 gauge galvanized steel and finished in baked enamel. The bottom panel shall be easily removed to provide service access to the burners, pilot and orifices. The pilot shall also be accessible through a side panel access plate.
- I. Draft Diverter
  - 1. Draft Diverter shall be no lighter than 20 gauge material.
  - 2. Draft Diverter shall be corrosion resistant aluminized steel.
- J. Flue vent fan shall be provided with all fixtures for field mounting and wiring.
- K. Burner and Burner Controls
  - 1. Gas Burner shall be atmospheric type with adjustable combustion air supply. The Gas Burner on the Tubular Heat Exchanger Models shall be inshot burner with hot surface pilot ignition.
  - 2. Burners shall be corrosion resistant.
  - 3. Burner shall be welded at each port to maintain flame integrity and then spot welded. V-shaped stainless steel flame spreader shades ports from dust and rust.
  - 4. Burner shall be individually removable for ease of inspection and servicing.
  - 5. Gas Burner Safety Controls: Thermo-couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.
- L. Controls
  - 1. A factory-installed junction box shall be provided for all power connections. A 24-volt transformer, high limit and a fan time delay relay shall be provided.
  - 2. High Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on high bonnet temperature and re-energizes when temperature drops to lower value.
  - 3. The unit shall be suitable for natural gas and have a two stage gas control and intermittent pilot ignition with electronic flame supervision and timed lockout.
  - 4. Fan Control: A fan time delay switch shall be provided and shall be controlled by a low voltage room thermostat by Controls Contractor.
- M. Operational Controls
  - 1. Controls Contractor shall provide universal guard for room thermostat.
- N. Additional Items:

1. Discharge Louvers: Individually adjustable vertical louvers to match cabinet finish.
2. High gas line pressure regulator shall be supplied to accommodate a main gas line pressure of 3 to 5 inches water column.

#### 2.11 HOSE REEL FLEX DUCT

- A. Manufacturer based upon Monoxivent Series 9000-W-TMTR (Tube Type, Chain Driven) or equal by Carmon.
- B. The vehicle exhaust extraction system shall consist of a hose reel with a single phase UL approved, totally enclosed, 120 V, 60 hz, 3.8 AMP, 430 Watt Motor, Limit Switches, and Chain Drive mechanism. Motor and drum rotate at 14-RPM.
- C. Motor to be operated by a spring rocker switch. Rocker switch to be either mounted on the wall, column, or switch may be wired directly to the hose reel and power cord dropped from the reel with the rocker switch mounted in box. Strain relief fittings to be used at both the box and junction on hose reel.
- D. The Hose Reel shall consist of the following features: The hose reel side mounting support frame shall be constructed of 11-gauge cold rolled steel. The side plates shall be drawn securely together by two heavy gauge "J" channel steel support braces. Each side plate has two pre-drilled 9/16" diameter holes for mounting of the hose reel.
- E. The hose drum shall be constructed of 16-gauge cold rolled steel. The drum shall be formed and rolled to an 18" diameter and strengthened by four inner support bars. These bars are secured to the drum end flanges and pull the drum tightly against the end flange.
- F. The drum end flanges shall be constructed of 16-gauge cold rolled steel. The end flange outer edge shall be rolled to provide strength and rigidity. Each end flange shall have a center pressed 18" diameter groove. This groove allows the reel drum and end flange to mate so the drum is always centered in relationship to the end flange. The drum's inner support bars draw the end flange securely to the drum for added strength, quality, and reliability.
- G. The hose reel shall have a hose to drum connection fitting allowing for use of either 4", 5", 6", or 8" hose. The connection fitting supports an inner 6" or 8" diameter tube that completes the connection from the extraction hose to the side discharge connection fittings. The side discharge fitting is a complete bearing fitting and allows for the connection of the 6" or 8" diameter discharge duct.
- H. The hose reel drum shall also be supplied with a hose tracking guide bar to guide the hose during recoiling function.
- I. Provide junction box on hose reel for connected vehicle exhaust fan control box/electrical panel low voltage wiring and P4 pendulum switch low voltage wiring and line voltage wiring power cord.
- J. The entire hose reel shall be protected by P&L Virtralon polyester powder coating for longevity and to resist corrosion.
- K. Hose reel flex duct and vehicle exhaust fan shall be furnished as one piece on the same support.

## 2.12 VEHICLE EXHAUST FAN

- A. Manufacturer based upon Monoxivent Series D15-LS-3-DMHR or equal by Carmon.
- B. Blower shall be mounted by flange connected directly to hose reel.
- C. Provide motor support strapping by factory.
- D. The D Series Blower shall be a high-quality pressure style unit. The construction is Silumin (Silicon Aluminum Alloy) for the housing and the wheel. Standard Motors are Baldor with TEFC Enclosure. Standard Motors are UL UR Recognized as a component and CSA Certified in Canada. The D-Series Blower shall be made in the USA.
- E. TEFC Motor 3450 RPM UL UR Recognized as a component.
- F. Top Housing shall be constructed of Cast Silumin (Silicon Aluminum Alloy).
- G. Radial Wheel shall be constructed of Cast Silumin (Silicon Aluminum Alloy).
- H. Radial Wheel shall be constructed of Cast Silumin (Silicon Aluminum Alloy).
- I. The D Series Blower is a versatile exhauster, constructed of Silumin (Silicon Aluminum Alloy).
- J. The D Series Blower shall be supplied with a mounting bracket.
- K. Voltage: 3-Phase, 460 Volt, 60HZ.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. General: Install work as indicated, in accordance with manufacturer's instructions. Locate properly, plumb and level and securely attach to substrate foundations.

### 3.2 VIBRATION ISOLATORS AND SEISMIC RESTRAINTS

- A. All vibration isolators and seismic restraint systems must be installed in strict accordance with the manufacturers written instructions and all certified submittal data.
- B. Installation of vibration isolators and seismic restraints must not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.
- C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- D. The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless insulation unless otherwise specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- E. Coordinate work with other trades to avoid rigid contact with the building.



- F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractors' expense.
- G. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractors' expense.
- H. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense.
- I. Over stressing of the building structure must not occur because of overhead support of equipment. Contractor must submit loads to the structural engineer of record for approval. Generally bracing may occur from:
  - 1. Flanges of structural beams.
  - 2. Upper truss cords in bar joist construction.
  - 3. Cast in place inserts or wedge type drill-in concrete anchors.
- J. Seismic cable restraints as specified under products shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
- K. Seismic cable assemblies as specified under products are installed taut on non-isolated systems. Seismic solid braces as specified under products may be used in place of cables on rigidly attached systems only.
- L. At locations where seismic restraints are attached to pipe clevis, the clevis cross bolt must be reinforced with pipe clevis bolt braces as specified under products.
- M. Drill in concrete anchors for ceiling and wall installation shall be stud wedge type or female wedge type for floor mounted equipment as specified under products.
- N. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.
- O. Where piping passes through walls, floors or ceilings, the vibration isolation manufacturer shall provide split wall seals as specified under products.
- P. Air handling equipment and centrifugal fans shall be protected against excessive displacement, which results from high air thrust in relation to the equipment weight. Horizontal thrust restraint shall be as specified under products.
- Q. Locate isolation hangers as near to the overload support structure as possible.
- R. Vibration Isolation of Ductwork
  - 1. All duct runs having air velocity of 1000 fpm or more shall be insulated from the building structure and spring deflection shall be a minimum of 0.75".

S. Seismic Restraint of Duct Work

1. Seismically restrain all ductwork with seismic cable restraints or seismic solid braces for SMACNA seismic hazard level "A" and connection level "Z" as listed below:
  - a. Restrain rectangular ducts with cross sectional area of 6 sq. ft. or larger.
  - b. Restrain round ducts with diameters of 28" or larger.
  - c. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
2. Transverse restraints shall occur at 30' intervals or at both ends of the duct run if less than the specified interval. Transverse restraints shall be installed at each duct run and at each end of a duct run.
3. Longitudinal restraints shall occur at 60' intervals with at least one restraint per duct run. Transverse restraints for one duct section may also act as a longitudinal restraint for a duct section connected perpendicular to it if the restraints are installed within 4' of the intersection of the ducts and if the restraints are sized for the larger duct. Duct joints shall conform to SMACNA duct construction standards.
4. The ductwork must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze.
5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
6. Walls, including gypsum board nonbearing partitions, which have ducts running through them may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.

T. Seismic Restraint Exclusions

1. Duct Work
  - a. Rectangular, square or oval ducts less than 6 sq. ft. in cross sectional area.
  - b. Round duct less than 28" in diameter.
  - c. All duct suspended by hangers 12" or less in length as measured from the top of the duct to the point of attachment to the structure. Hangers must be attached within 2" of the top of the duct with a minimum of two #10 sheet metal screws. If the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.
2. Suspended Equipment

- a. Fan powered equipment weighing less than 50 lbs. and rigidly connected to the supply side of the duct system support with a minimum of four hanger rods.

### 3.3 DUCT SYSTEMS

- A. All ductwork installation shall be coordinated with consultant's drawings, notes and specifications.
- B. Ductwork shall be fabricated to field measurements established by the Contractor on the job. Ducts shall be of sizes and configuration shown on the drawings.
- C. All ducts shall be installed true to line and grade. All horizontal ducts shall be installed tight to structure to leave the greatest possible space under them. Where necessary, changes of elevation in the ducts shall be made to secure this result, but not without approval of the Architect.
- D. Should it be found that any necessary duct dimensions have been omitted from the drawings, Contractor shall notify the Architect, who will supply the dimensions and the Contractor shall then construct the ducts in accordance with these sizes at no extra charge. Should it be found impractical to install any duct of the exact sizes given, a duct of a different shape but having the same resistance shall be installed. The sizes of the substitute duct shall be approved by the Architect.
- E. All transverse seams in duct system shall be SMACNA 7-17 pocket lock standing seam sealed airtight with U.L. listed duct sealer which meets Class 1 requirements of NFPA 90-A, as manufactured by "United", "Duro-Dyne" or approved equal.
- F. Ductwork layout: Follow as close as possible layout indicated on drawings. Secondary beams shall be furnished and installed under this Section of the specifications whenever necessary to meet these requirements.
- G. Swaged joints: Elbows in round ducts may be adjustable type formed by mechanically interlocked swaged joint. Three-piece adjustable elbows may be used for turns up to 45 degrees and five-piece elbows shall be used for turns greater than 45 degrees. Apply duct sealer to swaged joints to seal against air leakage.
- H. Tees and elbows connecting to round spiral ductwork shall have crimped ends for insertion limits. Tee fittings are required for all tee connections in conjunction with spiral ductwork. Cutting of the spiral ductwork for direct connection of a tee branch is prohibited.
- I. Branch duct outlets of tee fittings may be attached using Pittsburgh lock, clinch lock, and/or inside the collar attached with sheet metal screws and continuously caulked with duct sealer.
- J. Connection of round to rectangular ducts: Where more than one round duct connects into a rectangular plenum, spin-in fittings with manual damper or fittings with collars (having manual damper) attached by sheet metal screws may be used. These shall be completely made airtight at the joint by continuous caulking with duct sealer. Provide an adjustable extractor.
- K. Attach crimped and slip-in joints with sheet metal screw and make airtight with continuous caulking with duct sealer.

- L. Flexible round duct connectors: Length of a flexible round duct connector in any branch duct shall not exceed 6', but shall not be less than directed. The installation shall be such that the centerline radius of a bend shall be not less than two diameters. Connections to metal fittings shall be made with sealer and strap clamps. Excess length of the connector shall be cut off and not bunched together, thus impeding a proper air blow. Shall not penetrate any wall without the Architect's approval.
- M. Duct materials: Sides, including bottom and top of all ducts and plenums, shall be constructed of sheet metal. No portion of the building construction, such as walls or slabs, shall be used as part of any duct or plenum unless called for on the drawings or otherwise specified.
- N. Ductwork dimensions: Duct dimensions indicated are inside dimensions for the net free area. If ducts are lined, the duct dimensions indicated are dimensions for the net free area inside the lining and the outer, or overall, dimensions of the actual ducts shall be increased accordingly to accommodate the duct lining specified.
- O. Ductwork installation: Ductwork shall be installed true to line and grade and with seismic restraints in accordance with SMACNA Guidelines for Seismic Restraints of Mechanical Systems and Plumbing piping systems. Should it be found impractical to install any duct of the exact sizes given, a duct of a different shape but having the same resistance shall be installed. Ductwork shall be connected to fire/smoke damper sleeves or assemblies in such a way that collapse of the ductwork shall not dislodge the damper or impair its proper operation. In addition to seismic restraints per above standard, duct hanger construction and spacing shall be per Uniform Mechanical Code. The most stringent, the SMACNA Guidelines for seismic restraints, Uniform Mechanical Code or the State Mechanical Code, shall be applicable.
- P. Ducts shall not be supported from decking. Furnish and install structural members to span steel purlins to distribute the load. Refer to roof shop drawings for location of beams and purlins for additional structural members for hangers.
- Q. Outlets Installation: Diffusers, registers, and grilles in ceilings and walls shall be located in accordance with Architectural reflected ceiling plans and interior elevation plans whenever such drawings exist. Locations on Mechanical Drawings are only approximate.
- R. Changes in Duct Elevation, unless otherwise shown, fitting shall be made by either of the following:
  - 1. By curved sections of a minimum throat radius equal to the duct dimension in the place of the bend.
  - 2. By mitered elbows made with double thickness (formed) type turning vanes. Turning vanes in mitered elbows in lined ducts shall be factory manufactured extruded aluminum double thickness (formed) types with acoustical insulation between double wall and shall be approved equal to Sono Turn, manufactured by Sound Control Products Co., Palo Alto, California.
- S. Duct Transition Sections: Changes in the size of ducts shall be made by uniformly tapering sections with a maximum included angle of divergence of 20 degrees for enlargements and a maximum included angle of convergence of 45 degrees for contractions.

- T. Flexible Connections: Provide where indicated on drawings or at the ducted discharge and inlet of every air handling unit, fan-coil unit and fan. Connection shall be waterproof, fire-retardant and flexible.
1. Connection construction: At least 1" slack shall be allowed in flexible connections to ensure that no vibration is transmitted from fan to ductwork or plenum. The fabric shall either be folded in with the metal or attached with metal collar frames at each end to prevent air leakage. Equipment shall be arranged and access doors provided as necessary to permit the convenient replacement of the flexible connection after initial installation.
- U. Flashing Duct through Roof: Install flashing to cover top and sides of curb and fit closely around duct. Cover top edge of base flashing with a collar soldered to duct and turned down over base flashing. Fabricate flashing from 24-gauge galvanized steel sheet (minimum).
- V. Manual Volume Dampers:
1. Required in the following locations:
    - a. In each supply, return and exhaust duct branch.
    - b. In the main supply duct from a HVAC unit. Locate dampers close to unit.
    - c. Provide manual volume damper remote regulator for manual volume damper located above hard ceilings, non-removable ceilings and inaccessible ceilings, and at the location not readily accessible.
  2. Access doors in ducts and plenums:
    - a. Required in the following locations:
      - (1) Where specified herein
      - (2) Automatic damper access door location: At every automatic damper, locate an access door to provide convenient accessibility to a damper linkage and damper operator when mounted inside of the duct or plenum. Unless otherwise called for, access door not required when damper linkage and damper operators are conveniently accessible through a duct having open end.
- W. Automatic Dampers: Install automatic dampers called for elsewhere on drawings and in the specifications.

### 3.4 ACCESS TO EQUIPMENT

- A. General:
1. All ductwork, equipment, and accessories shall be installed to permit access for maintenance.

2. Any relocation of conduit, piping, equipment, and accessories required to provide maintenance access shall be accomplished by the Contractor at no additional cost to the Owner.
- B. Access:
1. Provide access doors where any dampers, instruments, controls, motors and other equipment requiring access for servicing, repairs or replacement are located behind walls, chases, or above non-removable ceilings.
  2. The location of access doors shall be coordinated with and installed by the applicable trade installing walls or ceilings.
  3. Contractor shall arrange for the necessary openings in the building to allow for admittance of all apparatus.

### 3.5 AIR INLETS

- A. Any intake duct not protected by a louver, grille, or register shall have a 1/2" mesh-galvanized screen over an open end.
- B. Paint ductwork visible through grilles, registers, and other openings with one coat of flat black paint.

### 3.6 PIPING SYSTEMS

- A. General: All apparatus, fixtures, devices and appliances which require pipe connections shall be so equipped and each such pipe connection shall be valved or trapped, or provided with special apparatus as indicated on the drawings or elsewhere specified. Where such connections are not indicated on the drawings or specified, they shall be made in the usual manner recommended by the manufacturer of each such equipment.
- B. Reduced fittings shall be used in lieu of bushings. Close nipples will not be permitted.
- C. Pipe lines shall be installed in the locations and of the sizes shown on the drawings or specified herein and of the materials and workmanship herein specified and shall be free from all stains, tool marks, or other foreign substances.
- D. All piping shall be installed parallel to or at right angles to the building walls. All pipelines shall be installed free from traps and air pockets and true to line and grade. All horizontal lines shall be installed as close to the building construction as possible so as to leave the greatest possible head room under them.
- E. The only filler that may be used in making up screw joints in pipe lines shall be an approved graphite paste or Teflon tape.
- F. Where pipes of two dissimilar metals are joined, "Mallory" dielectric couplings or approved equal shall be installed.
- G. Flexible Connectors: Provide where indicated on drawings or at every hydronic equipment (pumps, chillers, cooling towers, boilers; etc.), air handling unit, fan-coil unit and etc.

H. Hangers and Supports:

1. All horizontal pipe lines shall be carried by hangers or supports spaced according to the following schedule:

SCHEDULE 40 Size	STEEL PIPE Maximum Spacing	COPPER TUBING Tube O.D.	Maximum Spacing
1-1/4" or less	8'-0"	5/8" or less	6'-0"
1-1/2" - 2-1/2"	10'-0"	7/8" – 1-1/8"	8'-0"
3" or larger	12'-0"	2-5/8"-5-1/8"	12'-0"

2. Where two or more lines are run at the same elevation, trapeze hangers constructed of "Unistrut" or "Elcen" channels with rods as specified herein may be used. Provide separate hangers for each branch offset three feet or more in length. All hangers shall be set so as to allow the pipe to adjust itself to changes produced by expansion and contraction.
3. Pipes shall not be supported from decking. Furnish and install structural members to span steel purlins to distribute the load. Refer to roof shop drawings for location of beams and purlins to provide additional structural members for hangers. Provide additional supports for upper attachments for piping supports with a secondary steel support system consisting of a structural steel channel securely between beams or purlins. Furnish additional "Unistrut" channel (back-to-back 1-5/8" x 1-5/8" x 0.010" roll formed) members. Clamp, brackets, etc., for complete support of piping and sway bracing. Do not penetrate metal decking with fasteners.
4. Hangers, unless otherwise noted on the drawings, for all pipelines shall be heavy-duty clevis type: "Grinnel" Fig. 260 or approved equal. Hangers shall be supported on threaded rod hangers of the following minimum sizes:

PIPE SIZE	ROD DIA.
2" and less	3/8"
2-1/2" and 3"	1/2"
4" and 5"	5/8"
6"	3/4"

5. Seismic Bracing: Where hanger rods on horizontal runs of pipe are 24" in length or longer, Contractor shall provide transverse and longitudinal sway bracing angles in accordance with SMACNA Seismic Restraint Guide for Piping or Uniform Mechanical Code, whichever is the most stringent.
6. Condensate Drain (Waste) shall be installed in accordance with local code. Collect from air coils, fuel-burning condensing appliances, overflows from water-supplied equipment and discharge to approved plumbing fixture. Slope shall not be less than 1%. Size shall not be less than specified CMC.
7. Identification of Piping: Paint and identify all exposed piping, as specified in Section 23 05 00.

### 3.7 PIPE TESTING

- A. Test condensate drain piping system for leaks with a soap solution.

### 3.8 FINAL CONNECTIONS

- A. Provide final connections to all equipment including all fill or make-up water for heating and cooling systems.

### 3.9 EXAMINATION AND PREPARATION

- A. Verify that ductwork has been tested for leakage in accordance with SMACNA standards before applying insulation materials.
- B. Verify that all equipment and surfaces are clean, dry and free of foreign material.
- C. Verify piping has been tested as specified.

### 3.10 INSULATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Continue insulation vapor barrier through penetrations, except where prohibited by code.
- C. Piping Insulation
  - 1. Locate insulation and cover seams in least visible locations.
  - 2. Neatly finish insulation at supports, protrusions and interruptions.
  - 3. Provide insulated dual temperature pipes or cold pipes conveying fluids below ambient temperature with vapor retardant jackets with self-sealing laps. Insulate complete system.
  - 4. In dual temperature systems seal all pipe terminations including fittings, wall penetrations and pipe supports with vapor barrier mastic. In brine or chilled water, pipe systems seal pipe terminations every four pipe sections.
  - 5. For insulated pipes conveying fluids above ambient temperature, secure jackets with a self-sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation of equipment, flanges, and unions.
  - 6. Provide inserts between support shield and piping on piping 1-12" inches diameter or larger. Fabricate of Johns Manville Thermo-12 or other heavy density insulating materials suitable for temperature. Insulation inserts shall not be less than the following lengths:

1" to 2-1/2" pipe size	10" long
------------------------	----------
  - 7. For pipe exposed in mechanical equipment rooms or in finished spaces, finish with aluminum jacket.



8. For exterior applications, provide weather protection jacket or coating. Insulated pipe, fittings, joints and valves shall be covered with aluminum jackets. Jacket seams shall be located on the bottom side of horizontal piping.
- D. External Ductwork Insulation:
1. Provide specified thickness duct liner.
- E. Exterior Ductwork Installation:
1. Provide slope on top of duct between the center of duct and longitudinal edges by cross breaking duct.
- F. Duct Liner:
1. Adhere insulation to sheet metal with full coverage of a UL listed adhesive ASTM C 916.
  2. In addition, secure insulation with mechanical liner fasteners in a manner indicated by SMACNA or manufacturer. Pin length should be such as to limit compression of liner to 1/8".
  3. All exposed edges of the liner must be factory or field coated. For systems operating at 2000 fpm or higher, a metal nosing must be installed in all liner leading edges.
  4. Repair liner surface penetrations with UL listed adhesive. ASTM C 916 or superseal.
  5. Duct dimensions indicated are net inside dimensions. Increase duct size to allow for insulation thickness.

### 3.11 DUCTWORK LEAKAGE TEST

- A. Contractor shall conduct leakage test on all metal ductwork (supply air systems, return air systems, outside air systems, exhaust air systems; and etc.) The test shall be performed prior to installing external ductwork insulation, except internally lined ductwork.
- B. Systems shall be inspected and tested to positive and negative pressures, in accordance with the following:
1. There are no visible mechanical defects.
  2. There is no audible leakage at any point when area ambient noise is at normal occupancy level.
  3. No leakage is perceptible to the hand, when placed within 6 inches of a joint.
- C. Measured total system leakage shall not exceed 5 percent of total system cubic feet per minute (cfm) when tested in accordance with "Leak Tests."
- D. Leak Tests

1. Test Apparatus and Test Procedures shall as describe in Items E and F below. Filtered blower inlet and automatic safety relief device shall be provided to protect system. Accuracy of measurement of leakage flow rate shall be certified to be within 5 percent of total system flow.

E. Test Apparatus

1. Test apparatus shall consist of:
  - a. A source of high pressure air – a portable rotary blower or tank type vacuum cleaner.
  - b. A flow measuring device usually an orifice assembly consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated to its own calibration curve. Pressure and flow readings are usually taken with U-tube manometers.

F. Test Procedures

1. Test for audible leaks as follows:
  - a. Close off and seal openings in the duct section to be tested. Connect the test apparatus to the duct by means of a flexible duct section.
  - b. Start the blower with its control damper closed (some small blowers popularly used for testing ducts may damage the duct because they can develop pressures up to 25 inches wg).
  - c. Gradually open the inlet damper until the pressure reaches 2 inches wg. Test pressure is read on manometer No. 1. Note that the pressure is indicated by the difference in level between the two legs of the manometer and not by the distance from zero to the reading on one leg only.
  - d. Survey joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.
2. After all audible leaks have been sealed, the remaining leakage should be measured with the test apparatus orifice section as follows:
  - a. Start blower and open damper until duct pressure 2 inches wg. Test pressure.
  - b. Read the pressure differential across the orifice on manometer No. 2. Leakage rate in cfm is read directly from the calibration curve. If leakage does not occur the pressure differential will be zero.
  - c. Total allowable leakage should not exceed 5 percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

- d. If all audible leaks have been corrected, it is unlikely that the measured leakage will exceed one percent of capacity. If it does, the leaks shall be located by careful listening or feeling along the joint.
- e. It should be noted that even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak that shall be corrected.

G. Test Report Criteria

- 1. A test report shall be provided for each system tested, identified by system or section thereof, and containing leak-test curves for apparatus used and data pertinent to acceptance requirements.

3.12 BALANCING

- A. Total system balance shall be performed by an agency approved by the Owner's Representative. All work done by this agency shall be by qualified technicians under the direct supervision of a Certified Test and Balance Engineer.
- B. The responsibility for performing total system balance is "the overall concept requires that one source be responsible for the complete testing, adjusting and balancing of all water and air systems."
  - 1. Total system balance shall be performed in accordance with the latest edition of the test agency standards in accordance with the scope of work specified in the contract documents.
- C. Total system balance shall not begin until systems are complete.
- D. One agency shall be responsible for all phases of total system balance.
- E. The Test and Balance Agency shall permanently mark the settings of all valves, dampers and other adjustment devices in a manner that will allow the settings to be restored. If a balancing device is provided with a memory stop, it shall be set and locked.
- F. The name of the Test and Balance Agency, plus the name and registration number of the Certified Test and Balance Engineer, shall be submitted to the Owner's Representative for approval within 30 days after the award of the project contract.
- G. The select Test and Balance Agency shall submit to the Owner's Representative:
  - 1. Detailed procedures
  - 2. Agenda
  - 3. Report Forms
  - 4. Agency Project Performance Guaranty
  - 5. An approved copy of each of the above must be returned to the Test and Balance Agency before total system balance is begun.

- H. If a complete submittal in accordance with previous paragraphs is not received within the specified time, the Owner's Representative reserves the right to select the Test and Balance Agency.
- I. The Contractor shall provide the Test and Balance Agency with data specified in the standards.
- J. Quality Assurance
  - 1. Test and balance agency shall be a company specializing in the adjusting and balancing of systems specified in this Section with minimum three years documented experience certified by AABC. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor registered Professional Engineer.
  - 2. Total system balance agency shall be a company specializing in the adjusting and balancing of systems specified in this Section with minimum three years documented experience certified by AABC. Perform work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor registered Professional Engineer.
- K. EXAMINATION
  - 1. Before commencing work, verify that systems are complete and operable. Ensure the following:
    - a. Equipment is operable and in a safe and normal condition.
    - b. Temperature control systems are installed complete and operable.
    - c. Proper thermal overload protection is in place for electrical equipment.
    - d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
    - e. Duct systems are clean of debris.
    - f. Correct fan rotation.
    - g. Volume dampers are in place and open.
    - h. Coil fins have been cleaned and combed.
    - i. Access doors are closed and duct end caps are in place.
    - j. Air outlets are installed and connected.
    - k. Duct system leakage has been minimized.
  - 2. Report any defects or deficiencies noted during performance of services to the Architect/Engineer.

3. Promptly report abnormal conditions in mechanical systems or conditions, which prevent system balance.
4. If, for design reasons, system cannot be properly balanced, report as soon as possible.
5. Beginning of work means acceptance of existing conditions.

L. Preparation

1. Provide instruments required for testing, adjusting and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.
2. Provide additional balancing devices as required.

M. Installation Tolerances

1. Adjust air handling systems to plus or minus 5 percent for supply systems and plus or minus 10 percent for return and exhaust systems from figures indicated.
2. Adjust all zones to plus or minus 5 percent.
3. Adjust more than one diffusers to plus or minus 10 percent.
4. Adjust hydronic systems to plus or minus 10 percent of design conditions indicated.

N. Adjusting

1. Adjust work under provisions of this Section.
2. Recorded data shall represent actually measured or observed condition.
3. Permanently mark settings of valves, dampers and other adjustment devices allowing settings to be restored. Set and lock memory stops.
4. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
5. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes and restoring thermostats to specified settings.
6. At final inspection, recheck random selections of data recorded in the report. Recheck points or areas as selected and witnessed by the Architect.
7. Check and adjust systems approximately six months after final acceptance and submit a report.

O. Air System Procedure

1. Adjust air handling and distribution systems to provide required or design supply, return and exhaust air quantities at site altitude.
2. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
3. Measure air quantities at air inlets and outlets.
4. Adjust distribution system to obtain uniform space temperature free from objectionable drafts and noise.
5. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
7. Provide system schematic with required and actual air quantities recorded at each outlet and inlet.
8. Measure static air pressure conditions on the air supply units, including filter and coil pressure drops and total pressure across the fan. Make allowances for 50 percent loading of filters.
9. Adjust outside air automatic dampers, outside air, return air and exhaust dampers for design conditions.
10. Measure temperature conditions across outside air, return air and exhaust dampers to check leakage.
11. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling and at a minimum air flow rate, full heating.
12. Measure building static pressure and adjust supply, return and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.
13. Check air-conditioning units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, and then modulating.
14. Take and submit temperatures during cooling mode and heating mode: OSAT, SAT, RAT, MAT, RoomT, etc.

### 3.13 TESTS

#### A. General:

1. All power, water and fuel required for tests will be furnished as specified under the General Conditions or General Requirements Sections. All other materials, gauges, test thermometers, and all labor necessary shall be furnished by this Contractor.

2. Should any piece of apparatus or any material or work fail in any of these tests, it shall be removed immediately and be replaced by perfect material at the Contractors expense. Any such portions of work so replaced shall be retested. All tests shall be performed in the presence of the Architect.

B. Equipment:

1. After the entire heating, ventilating and air conditioning system installation has been completed, all ducts installed, and all dampers adjusted, etc., a complete test of each air conditioning unit shall be made to determine whether the equipment fulfills the guarantee regarding the quantity of air delivered, efficiency, noiseless operation and other requirements.
2. Contractor shall furnish all labor necessary to adjust the operation of the apparatus and make the connections for the test. Contractor shall replace all fuses blown during the tests. After the tests, restore all connections, apparatus, etc., to their proper condition.
3. Contractor shall demonstrate proper operation of the temperature control system and control system interlocks.
4. Provide Owner with report certifying that all systems are operating properly.

3.14 OPERATION

- A. Operational Readiness: The Contractor shall insure that the complete installation including all equipment and controls, is complete, operating, checked, and adjusted at the time of final inspection. Contractor shall provide one complete extra set of filters, which shall be installed in all units prior to final inspection.
- B. The Contractor shall be held responsible for any delays incurred and/or reinspections required due to any lack of above-mentioned readiness.
- C. Each entire system shall be operated continuously for a period of three full days, at a time requested by the Owner, to prove that the systems will fulfill all guaranteed requirements.

-END OF SECTION-

**SECTION 260500  
COMMON WORK RESULTS FOR ELECTRICAL**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. Principal Work Items are: Provide all labor, material and equipment necessary to complete and test the electrical work as shown on the drawings and as specified herein. Work will include, but not limited to the following:
1. Underground duct banks and pre-cast concrete pull-boxes/manholes, including furnishing hardware and accessories (pulling eyes, drainage, necking, traffic cover, ladder, cable racks, perimeter grounding bus and ground rods) in each pull-box/manhole of the Power and Low Voltage Communication system (for telephone data copper, fiber-optic, low voltage control and Fire Alarm network systems).
  2. A complete electrical grounding system for the building, including electrical service grounding (Ground Rods in ground well, Uffer-ground and cold water pipe) and Low Voltage Communication system reference ground with a single point of ground connection at the Main Ground Bus.
  3. Supports, duct spacers, clamps, hangers, fastening devices, sleeves, slots, concrete bases, physical protection, caulking, weatherproofing, sealing, closing, etc.
  4. Relocation of utility services (power, fire alarm, fiber optic, tel/data, PV connections and etc.) services which are in the foot-print of the new building in this scope of work. The utility relocation works shall be done prior to grading works starting date.
  5. Complete installation and supply of 480/277 Volt and 208/120Volt, 3-Phase, 4-Wire Switchboard, Distribution Switchboards, Integrated Power Center Switchboard, feeders, pull-boxes, distribution transformers, control transformers, motor starters, disconnect switches, panel boards, branch circuit conduit and wiring and all other electrical devices.
  6. A complete grounding system for the 480/277 Volt and 208/120Volt separately derived systems and all of the electrical equipment.
  7. All Luminaires (lighting fixtures), including LED driver, electronic ballasts, lamps, occupancy/day light sensor, day light control, classroom lighting control system, corridor & lobby & exterior lighting control system and other control complete. Including the daylight dimming control system for the specified Tubular Daylight System as applicable.
  8. All exterior lighting fixtures including concrete bases for poles /low level area lights, walkway/bollard, step lights and planter lights.



9. All electrical work for the mechanical system, except as specified to be furnished or installed as part of other Sections in the Specifications.
10. All distribution materials and connection of the following listed equipment by the specific equipment furnished so that a complete and operable system results:
  - a. Building power, communication and fire alarm system connections to Campus systems.
  - b. Electrical operated roll down doors, gates and other type of door operator.
  - c. Electrical operated shades system as applicable.
  - d. Irrigation power connections.
  - e. Audio/Video equipment for classroom.
  - f. Hearing Assistance system.
11. Complete installation of the Central Lighting Inverter with battery back-up system in Nema1 enclosure for seismic zone 4 equipment, for the Emergency Egress Lighting system.
12. Furnish and install all hangers, anchors, sleeves, chases, access panels and supports required for electrical works.
13. Electrical conduit system rough-in.
14. Complete Fire Detection and Alarm system including all control equipment, devices, terminal cabinets, backboards, boxes, conduits, wiring, connections, and networking fiber connection to campus-wide network.
15. Complete system of empty conduit, outlets, back-boxes, cabinets and/or terminal backboards for the security distribution system or other low voltage /signal systems.
16. Complete system of conduit with voice/data cables, outlets with devices, back-boxes, cabinets and/or terminal backboards with terminating blocks or patch panels for voice/data distribution system.
17. Excavation, backfill and concrete works required to complete items of this section.
18. Closing of all openings resulting from coring, sleeving, removal of conduit and/or equipment.
19. Cleaning, patching, fire stopping/proofing seal, repairing and painting.
20. Permits and Code Inspection fees.
21. Prime coat painting of all electrical equipment exposed to view in public area where required and deemed necessary by Architect.

22. Identified and instruction plates, tags, labels, magnetic yellow tapes, underground warning tapes etc.
23. Shop drawings and technical data; operating instruction and maintenance manual.
24. Test of all equipment and system installed.
25. "As-built" drawings, including but not limited to record of actual routing of duct banks, location of Power Pull-boxes/Manholes and Communication Pull-boxes, lighting and power/communication plan as-built condition.
26. Incidental items not indicated on the drawings nor mentioned in the specifications that belong to the work described, or are required to provide complete systems, as though called out here in every detail.

B. Work in Cooperation with Other Trades:

1. Examine the Drawings and Specifications and determine the work to be performed by the electrical, and other trades. Provide the type and amount of electrical materials and equipment necessary to place this work in proper operation, completely wired, tested, and ready for use. This shall include all conduits, conductor, and all other devices for the required operation and control sequences of all electrical, and other existing systems or equipment.

## 1.2 SUBSTITUTIONS

- A. General: Only written approval of Architect will permit substitutions for materials specified; See division 1, Product Options and Substitutions for procedure.

## 1.3 QUALITY ASSURANCE

A. Standards:

1. Comply with standards listed in the following:
  - a. Underwriters' Laboratories Inc. (UL).
  - b. The 2019 California Electrical Code, National Electric Code (NEC) 2017 edition, with California Amendments.
  - c. The USA National Fire Code (NFPA).
  - d. The National Electrical Manufacturers' Association (NEMA).
  - e. Institute of Electrical and Electronic Engineers (IEEE).
  - f. American National Standards Institute (ANSI).
  - g. 2019 California Code of regulations, Title 24, Part 1, 2 and 3.
2. Off-Site Work: Conform to Governing Agencies requirements.

3. Earthquake Provisions: All electrical component shall be anchored and braced to meet the force and displacement requirements prescribed in the 2019 CBC, Sections 1615A.1.12 through 1615a.1.22 and ASCE 7-10 Chapter 6 and 13.
  4. In case of conflict among the reference standards, the more stringent provisions, better grade or quality shall govern and shall be resolved before installation at Contractor's expense. Prepare and secure approval for any clarifying details required by inspection authorities.
  5. Nothing in the Contract Documents shall be construed as authority to permit work not conforming to codes, ordinances, standards or regulations.
- B. Qualification Of Installers:
1. Throughout the progress of installation of the work of each Section, provide where required as indicated in respective Sections, at least one manufacturer's authorized representative who shall be thoroughly familiar with the specified requirements, completely trained and experienced in the necessary skills, who shall be present at the job site and shall direct all work performed under that particular Section.
  2. Cutting and patching finish work shall be performed by workmen of the proper trade.
- C. Qualification Of Manufacturers:
1. Manufacturers of the products supplied for this project shall have been in the business of manufacturing the particular product for at least five years and be able to prove a history of successful production acceptable to the Architect. As a condition for approval and when directed by the Architect, submit a list of past projects showing a minimum of five projects of similar scope to the Architect for approval.
  2. Provide together with the Shop Drawing submittal, where called for in these Specifications, a list of five projects which shall have been in satisfactory operation for the past five years.

#### 1.4 SUBMITTALS

- A. General: Refer to Division 1.
- B. Project Drawings:
1. The drawings are diagrammatic and indicate the general layout of the equipment.
  2. The exact location shall be field determined, after shop drawing review for the installation in available space at the job site.
- C. Manufacturers Data:

1. Within 30 calendar days after award of Contract, submit:
  - a. Complete materials list of all items proposed to be furnished and installed.
  - b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
  - c. Unless specifically call for otherwise, provide bound copies of catalog cuts for standard products, not requiring specifically prepared Shop Drawings, for the following:
    - 1) Wire and cable
    - 2) Conduit and raceways
    - 3) Outlet Boxes
    - 4) Convenience outlets
    - 5) Switches for lighting control.
    - 6) Disconnect switches for power control.
    - 7) Time clocks, photo controls.
    - 8) Contactors.
    - 9) Relays.
    - 10) Circuit breakers.
    - 11) Fuses.
    - 12) Motor starters.
    - 13) Dimmers for lighting systems.
    - 14) Standard lighting fixtures.
    - 15) Face plates for convenience outlets and light switches.
  - d. Where more than one item, size, rating or other variations appear on a catalog cut sheet, clearly identify all items to be provided and properly indexed and referenced to Architect's identification numbers, designations and/or details.
  - e. Provide specially prepared Shop Drawings, including but not necessarily limited to:
    - 1) Custom designed lighting fixtures.
    - 2) Special electronic lighting control system.
    - 3) Distribution switchgear and transformers.
    - 4) Panelboards.
    - 5) Fire alarm system and wiring diagrams.
    - 6) Engraved switch-plates.

- 7) Grounding system.
  - 8) Emergency power distribution system.
- f. No work shall be initiated or fabrication of any equipment started prior to Architect's return of reviewed submittals.

D. Operating Instructions and Maintenance Manuals:

1. Thoroughly instruct operating personnel designated by the Owner in the operation and maintenance of the equipment and systems installed.
2. Following approval of Shop Drawings of electrical equipment and prior to acceptance of electrical work, prepare 2 copies of operating and maintenance manuals in accordance with Division 1, describing operating, servicing, and maintenance requirements of electrical equipment installed under Division 16 with particular emphasis on safety devices. Operation and Maintenance Manuals shall cover all electrical equipment and systems including but not limited to the following:
  - a. Distribution switchgear and metering.
  - b. Panelboards.
  - c. Fire alarm and Detection system.
  - d. Transformers.
  - e. Motor starters.
  - f. Contactors.
  - g. Time clocks.
  - h. Relays.
  - i. Fuses.
  - j. Circuit breakers.
  - k. Any special electrical equipment.

E. Information contained in the manual for the above equipment shall include the following:

1. Manufacturer's catalog cuts and printed descriptive bulletins.
2. Manufacturer's installation, operating, and maintenance instruction booklets.
3. Parts list and costs.
4. List of recommended spare parts for 12 months" operation.
5. Name, address, and phone number for the closest source of spare parts.
6. Wiring and schematic diagrams.

## 1.5 PRODUCT HANDLING

- A. Protection: Protect materials before, during, and after installation and protect installed work and materials of all other trades.
- B. Replacement: In the event of damage, immediately make all repairs and replacements necessary for the approval of the Owner's Representative and/or Architect and at no additional cost to the Owner.
- C. Delivery and Storage: Deliver all materials to the job site in their original unopened containers, where applicable, with all labels intact and legible at time of use. Store in strict accordance with the manufacturers' recommendations as approved by the Owner's Representative.

## 1.6 PERMITS

- A. General: Secure permits and pay all required fees for the installation of the electrical work.

## 1.7 RECORD DRAWINGS

- A. General: Refer to Specification Division 1, Contract Close-Out, "Project Record Documents", for requirements.
- B. Record Drawings and Operating and Maintenance Books
  - 1. Record Drawings (Refer to Division 1): On completion of work, furnish the Owner through the Architect, with a complete set electronic record drawings and shop drawings which properly reflect the locations of all equipment, fixtures, wiring junction box, pull box, feeder routing, underground feeder routing and etc., as actually installed. Where necessary to locate concealed equipment, dimensions, shall be included on these drawings. Maintain a separate set of drawing prints at the job site for such marking of "As-Built" locations. This set shall be updated as the installation work progresses and shall be available to the Architect at job visits. The Contractor shall indicate on the "As-Built" Drawings all deletions in green. All additions, relocations, rerouting and modifications shall be indicated in red.
  - 2. The format shall be AutoCAD or Revit release 2016 or later. A USB Drive with the electronic model will be supplied to the successful bidder for this purpose. Monthly changes shall be made to the drawings on a layer named "record" and the color shall be green. A copy of the model on diskette with any "as-built" changes shall be submitted to the Architect along with all payment applications.
  - 3. At the end of the project, the Contractor shall take "as-built" drawings modifying the electronic drawing files to show all changes, modification or additions made

during construction. These drawings will become "Record Drawings" to be delivered to the Architect.

4. Final Record Drawings shall include legends, schedules, plans, sections and details.
5. All Record Drawings shall be marked on the lower right corner with the following:
  - a. Name of Contractor
  - b. Record Drawings
  - c. Date
  - d. Building Permit Number

Letter shall be bold and print 1/4 inches high minimum.

6. Contractor shall submit to the Architect; Record Drawings as follows:
  - a. Four (4) USB Drives (AutoCAD or Revit 2016 or later)
  - b. Four (4) hard copy prints

7. The Architect will distribute the final Record Drawings as follows:

	OWNER	ARCHITECT	ENGINEER
USB Drive	1	1	1
Prints	1	1	1

8. Delivery of complete set of Record Drawings is one condition for the release of Contractor's final payment under the Contract.

C. Operating and Maintenance Books

1. Operating and Maintenance Books (Refer to Division 1): Provide the Owner through the Architect, operating instructions and maintenance data books for all equipment and materials furnished under this Division.
2. Submit five (3) copies of operating and maintenance data books to the Architect for review two weeks before final inspection of the project. Assemble all data in a single complete indexed volume and identify the size, model and features indicated for each item, including copy of all guarantees and warranties issued on the installation showing all dates of expiration on separate Tab.

## 1.8 CERTIFICATES

- A. General: Refer to Specification Division 1, Contract Close-Out, for requirements.

## 1.9 GUARANTEE

- A. Conform to applicable provisions of Division 1 of the General Requirements of these specifications.
- B. Manufacturers Guaranties: Submit guarantees for all applicable equipment and devices.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. General: See General Conditions, Article titled "Materials".
  1. Architect shall be the sole judge of material conformance to Contract Documents. Equal products shall be as selected by the Architect.
  2. All materials and products shall be new and in perfect condition, and of the manufacturer's latest type and model. Unless otherwise noted, each material or product type shall be from one manufacturer only.
  3. All exterior mounted electrical boxes, devices and miscellaneous items shall be tamper-proof assemblies. Where not a standard feature, shop modify assembly to meet this requirement.
  4. Where any devices or equipment is referred to or indicated in these documents or on the Drawings in the singular number, such reference shall be deemed to apply to as many such devices as are required to complete the intended installation as specified and/or as shown on the Drawings.
  5. In case of conflicts among Drawings and Specifications, the more stringent requirement, larger quantities, better qualities and/or more proper application and installation for the particular situation shall govern.
  6. Wherever "finishes" are indicated to be selected by the Architect, such "finishes" shall include all standard as well as optional finishes offered by the Manufacturers.
  7. All materials shall be U.L. listed where applicable.
- B. Manufacturer and Catalog Numbers:
  1. Where manufacturer and catalog numbers are indicated, the published data on the product by the manufacturer are deemed to be part of this specification.
  2. Numbers used indicate basic minimum design and appearance required, and must be modified to meet all specific requirements of Contract Documents.



3. Before submitting bid, verify availability of such modification. Where manufacturers cannot meet these modifications, notify Architect 10 days prior to bid date and deem these products removed from approved list of equipment.
4. Act of submitting bid is certification that all equipment specified, with required modifications, is available from at least one manufacturer listed.

## 2.2 CONDUIT

- A. General: Provide only new conduit with UL listing or label and deliver to the site in standard lengths.
- B. Types:
  1. Rigid Steel Conduit and Couplings: Hot-dipped galvanized or sherardized inside and out, with galvanized threads. Electro-galvanizing is not acceptable. Provide insulated throat metallic bushings.
  2. Rigid Plastic Conduit: Extrude from virgin polyvinyl chloride compound, Schedule 40 heavy wall, in 10'-0" (3 m) lengths with couplings. Where threaded connection is required or for allowed exposed application where subject to physical damage provide Schedule 80 conduit.
  3. Electric Metallic Steel Tubing: Hot-dipped galvanized or sherardized inside and out, with galvanized threads. Electro-galvanizing is not acceptable. Provide insulated and bushed tap-on type connectors and couplings as made by Tomic or T&B, or wrench-tightened compression type couplings. Set-screw type couplings or connectors are not acceptable.
  4. Flexible Conduit: Manufacture from single strip steel, hot-dip galvanized on all four sides prior to conduit fabrication. Provide insulated die-cast connectors with ridges that thread into the inside of the conduit to ensure a force fit as made by T&B or approved equal. Binding-screw type connectors are not acceptable.
  5. Liquid-Tight Flexible Conduit: Identical to flexible steel conduit but with overall polyvinyl chloride plastic jacket. Provide insulating connectors, Appleton STN series, or approved equal.

## 2.3 WIRE AND CABLE – 600 VOLTS AND LESS

- A. General:
  1. All wire and cable shall be soft-drawn annealed copper with 98-percent conductivity; 600-volt insulation, unless otherwise noted. All wire and cable shall be new and manufactured not more than 12 months prior to installation. Each coil or reel shall bear the UL label and shall be marked with AWG or circular wire size, voltage rating, insulation type, type of stranding, (and shielding, where applicable), manufacturer's name, trade name, month and year when manufactured. Wire

shall be marked continuously with at least insulation type, wire size and voltage rating.

2. All conductors used for power and lighting operation at 600-volt and below shall have a minimum insulation rating of 600-volt.
3. Minimum wire size used shall be #12 AWG except for control circuits which may be #14 AWG.
4. Conductors for all other auxiliary and signal systems shall be as indicated or as required or recommended by the system equipment manufacturer.

B. Types:

1. Conductors shall be "THWN-THHN"; #10 AWG and smaller shall be solid type; #8 AWG and larger shall be stranded.
2. Conductors installed in areas subjected to temperatures exceeding 140°F; terminating in incandescent lighting fixtures and installed through or into housing containing ballasts shall be type AVA.
3. Aluminum Conductors: No aluminum conductors are allowed.

## 2.4 FLUSH FLOOR COUPLINGS

- A. General: Provide flush floor couplings, whether shown on the Drawings or not, for exposed conduit stubbing up through finished floors.
- B. Types: For sizes 3/4-inch through 2-inch, provide brass type complete with slotted brass plug, Russell and Stoll No. 1920 inclusive. For conduit larger than 2-inch, use regular coupling with plumber's type brass plug.

## 2.5 OUTLET BOXES

- A. General:
  1. Provide all boxes necessary for proper installation of electrical work in compliance with applicable codes and regulations whether required box is specifically indicated on the Contract Documents or not.
  2. Boxes shall be 1-piece galvanized pressed steel knockout type, minimum size 4-inch square by 1-1/2-inch, in all wall and ceiling locations unless otherwise indicated or required.
  3. Cast boxes shall be ferrous or aluminum with threaded-hubs and dipped in rust inhibitor.

## 2.6 PULL BOXES

- A. General:

1. Where pull boxes are indicated as required in wall, ceiling and in dry locations, provide boxes constructed of code-gauge sheet steel finished with one coat of metal primer and one coat of primer sealer.
  2. All pull boxes in wall or in ceiling shall be recessed or concealed unless otherwise noted.
  3. Provide pull boxes with screw-on type covers. Provide a minimum 1-inch all around flange for recess mounted type.
- B. Where located outdoors, in wet locations or indicated as weatherproof, provide pull boxes constructed in code-gauge steel, hot-dipped galvanized after fabrication and finish with one coat of metal primer and sealer. Install cover with stainless steel tamper-proof captive screws and neoprene gaskets. Seal around conduit entries with silicone sealant.
- C. In precast concrete walls or concrete masonry unit walls, provide surface mounted die cast copper free aluminum alloy A360 FS/FD device box and covers.

## 2.7 CAST-IRON PULL BOXES

- A. General: Provide cast-iron pull boxes as indicated on Drawings or as required for the particular purpose. Exact locations of each box shall be determined after careful consideration has been given to coordination with other utilities, grading, paving and shall be approved by the Architect prior to installation.
- B. Pull Boxes: Conform to all Code requirements as to size for conduit entry and thickness of metal used in fabrication or casting.
- C. Enclosure: Provide watertight type with mounting lugs when required for surface mounting. For recess mounting, provide same type except with integral flange or trim and mount flush with the finish grade.
- D. Conduit Entry: Provide bossed, drilled, and tapped holes with a minimum of five full threads for each conduit entry.
- E. Covers: Provide neoprene gasketed plain or checkered type cover with letter designation as indicated on the Drawings cast in the cover. Submit shop drawings to Architect for approval prior to casting. Cover shall have captive-type stainless steel screws. Provide traffic-type cover where subject to vehicular loads, including lift trucks.
- F. Acceptable Manufacturers: Provide units as manufactured by Alhambra Foundry Company, Spring City Electrical Manufacture Company, Russel and Stoll, or O.Z./Gedney Co.

## 2.8 STAINLESS STEEL

- A. General: Where stainless steel is indicated or used for any portion of the electrical work, provide ANSI Type 302 or 304, with a satin finish. Provide the finished material free of all burrs. Exposed screws shall be of the same alloy.

## 2.9 GROUND WELL AND GROUND ELECTRODE

### A. Ground Well

1. Ground well shall be of the pre-cast concrete type with armored body and cast-iron lid. Inside dimensions shall be 10" (254 mm) diameter by 12" (305 mm) deep.
2. Provide permanent marking on top of lid identifying as "GROUND WELL".

### B. Ground Electrode:

1. Install a grounding electrode constructed of 3/4" (20 mm) diameter by 10 feet (3 m) long copper-weld rod driven vertically full length into the ground through the ground well.
2. Fill the inside of the ground well with a layer of fine sand and layer of crushed rock on top with the ground rod protruding approximately 3" (76 mm) above the two layers.

- C. Acceptable Manufacturers: Provide Brooks Product No. 3RT or approved equal by Quick set for the Ground Well and J.A. Weaver W-3410 for the grounding electrode

## PART 3 EXECUTION

### 3.1 MATERIALS AND WORKMANSHIP

#### A. General:

1. Materials and equipment shall be installed in accordance with approved recommendations of the manufacturer and conforming to the Contract Documents. Devices and equipment are laid out per requirements of one manufacturer. Modify work and arrangements to suit actual equipment installed and pay for all additional cost incurred, if any. The installation shall conform to the applicable codes, rules, and regulations. The Drawings indicate, in diagrammatic form, the work to be done rather than exact routing, location and arrangement of equipment, conduit, and wiring. Make use of data in Contract Documents, verify against developed field conditions, install work in an orderly arrangement in a manner to overcome structural and other interference.
2. Study all Drawings and properly locate the outlets and equipment so that they are readily accessible. Locate equipment and outlets to avoid interference with

mechanical or structural features. Do not support any electrical material, equipment or device from sheet metal roof decks or ductworks. If any conflicts occur necessitating departures from the Drawings, details of such departures and reasons therefore shall be submitted as soon as practicable for written approval.

3. Where developed conditions make revisions necessary to indicated locations and arrangements, Contractor shall make changes, at no additional cost, provided:
  - a. Change is ordered prior to time conduit is installed.
  - b. Length of conduit run is not changed more than 10%.
4. Architectural and structural drawings take precedence over electrical drawings in representation of general construction work, and drawings of various trades take precedence in representation of work of these trades. Refer to all Contract Documents and coordinate electrical work with other work.
5. Where discrepancies arise among the various Contract Documents, stop work in affected areas. Promptly notify Inspector of conditions.
6. Galvanic and chemical corrosion shall be prevented by isolating dissimilar metals and preventing contact of aluminum with concrete, plaster, mortar or earth.
7. All equipment shall be braced and/or anchored to meet the force and displacement requirements prescribed in the 2013 CBC.
8. The bracing and attachments to the structure shall be detailed on the approved drawings or they shall comply with one of the OSHPD pre-approvals (OPA #) as modified to satisfy anchorage requirements of ACI 318, Appendix D.
9. The Structural Engineer of Record shall verify the adequacy of the structure to support the hanger and brace loads.

### 3.2 WIRE AND WIRING METHODS

#### A. General:

1. Wiring and cable for all systems including low voltage, control circuits, and communication systems shall be installed in conduit or raceway unless otherwise noted.
2. Before installing conductors, remove debris and moisture from conduit and equipment enclosures. Use linseed soap, minerallac or other specifically approved wire pulling compound to facilitate the installation of conductors. Oil, grease or similar substances shall not be used as pulling compound.
3. Each circuit shall correspond to the branch circuit number or control circuit number as indicated. All control wiring shall conform to the wiring diagrams on the Drawings when indicated or as directed by Owner's Representative, and the manufacturer's wiring diagrams; and shall control the equipment in the manner specified under this and other Sections.

- B. Splices:
1. Make joints, splices, taps and connections for 600-Volt conductors with solderless connections. Use only plated copper alloy connectors or lugs; aluminum connectors or lugs are not acceptable.
  2. For copper conductors, the following connections are acceptable:
    - a. For #10 AWG and smaller: Use 3M "Scotchlok" or Ideal "Super Nut".
    - b. For #8 AWG and larger: Use T & B "Lock-Tie" connectors, Burndy Versitaps and heavy-duty connectors, or O.Z. solderless connectors.
  3. Re-tighten all bolt type connectors 24 to 48 hours after initial installation and before taping.
  4. Tape all connections made with non-insulated type connectors with rubber-type tape, 1-1/2 times the thickness of the conductor insulation, then cover with Scotch No. 33 tape
- C. Color Coding: Color code all feeders by means of factory color coded conductors. Each phase shall be the same color throughout the system and shall be a different color from other phases and other systems. The identified grounded neutral conductor shall be white, ground shall be green. Color coding for branch circuit wiring shall be per applicable codes and shall match those existing.
- D. Tagging:
1. Neatly arrange and lace conductors in switchboards, panelboards, gutters and terminal cabinets by means of nylon twine, Scotch No. 33 tape, or T & B "Ty-Rap" ties.
  2. Main and feeder cables shall be tagged in all boxes, panels, wireways, gutters and at terminal blocks. Tags shall identify where power source originates from, wire or cable number and equipment served and shall be made of flame resistant material.
  3. Tag wires for future use and tape exposed ends in same manner as required for non-insulated connectors.
- E. Voltage Drop: All branch circuits shall be limited to a maximum voltage drop of 3%. All feeders shall be limited to a maximum voltage drop of 2%. End of line maximum voltage drop not to exceed 5%. Increase branch circuit and feeder wire sizes where required to comply with these requirements.

### 3.3 CONDUIT AND TUBING

- A. Provide the type of conduit permitted in these Specifications or required for each location or condition per applicable codes and jurisdictions whichever is more stringent.

- B. Where conduit penetrates fire-rated walls or floors, provide pipe sleeve two sizes larger than conduit; pack void around conduit with oakum and fill ends of sleeve with fire-resistive compound. Provide mechanical fire-stop fittings with UL listed fire rating equal to wall or floor rating. Seal opening around conduit with UL listed foamed silicone elastomer compound.
- C. Conduit Usage:
1. Concrete or masonry in contact with earth and concrete block walls are not considered as dry locations.
  2. Rigid plastic conduit, PVC Schedule 40, may be used only underground and below slabs on earth.
  3. Use rigid metal conduit where Code required; where indicated as hazardous area; where exposed to the weather; where exposed at less than 7'-6" above the floor in areas accessible to anyone other than authorized operating or maintenance personnel; where underground; and where other types of conduits are not allowed in this Specification.
  4. Electrical metallic tubing (EMT) may be installed only within buildings above grade, in dry locations, and where allowed to be surface mounted or exposed at not less than 7'-6" above floor or otherwise prohibited. EMT may be used only for sizes 2-inch or smaller.
  5. Rigid plastic conduit, PVC Schedule 40, may be used only underground and below slabs on earth.
- D. Supports:
1. Support conduit at Code required intervals as a minimum. Provide additional supports where required or as directed by the Architect.
  2. Suspended conduit: Use malleable iron factory-made split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter), Kindorf or equal. For grouped conduits, construct racks with threaded rods and tiered angle-iron or unistrut cross members. Clamp each conduit individually to a cross member. Where rods are more than 12-inch long, provide rigid sway bracing.
  3. Wherever conduit may be affected by movements of the supporting structures or medium, and where secured on both sides of building control joints, provide suitable flexible or expansion devices.
  4. Conduits or pipe shall not be welded to steel structures.
- E. Locations:
1. Route conduit to avoid drains equipment hatch, other gravity lines and all obstructions. Where conflicts occur, relocate conduit as required.

2. Keep conduit at least 6-inch from the coverings on hot water pipes; at least 18-inch from the covering on exhaust flues and breechings; and at least 24-inch from radiant heaters.
3. Where exposed conduit runs are permitted, run conduit parallel with or at right angles to structural members, walls or lines of the building. Route exposed conduit to preserve headroom, access space and work space.
4. Changes in direction of runs shall be made with symmetrical bends or cast metal fitting. Field-made bends and offsets shall be made with an approved hickey or conduit-bending machine. Bending radius shall not be less than those allowed in the NEC. Crushed or deformed raceways shall not be installed or when installed, shall be changed as directed by the Architect.
5. Conduit may be run in concrete members or slabs only with previous written permission of the Architect. Individual written permission shall be obtained for each conduit run or for conduits within each definitive area or for each particular condition.

F. Joints, Bends and Fittings:

1. Where conduit is underground, under slabs or grade, exposed to the weather, or in wet locations, make joints liquid tight and gas tight. Seal conduit entries with silicone sealant.
2. Threaded Conduit: Use red lead and oil applied to the male threads only and tighten joints securely. For underground or under slab conduits, apply a heavy coat of Pabco P & B No. 2 paint after installation to surfaces within 6" (150 mm) on both sides of fittings and to areas where wrenches or other tools have been applied. On exposed conduits, repair scratches and other defects with galvanizing repair stick, Enterprise Galvanizing "Galvabar", or equal.
3. Plastic Conduits: Use approved solvent-weld cement specifically manufactured for the purpose.
4. Bushings shall be installed on ends of all conduits and shall be of the insulating type where required by applicable codes.
5. Cut threads on rigid conduit to standard taper and to length such that bare metal exposed by the threading operation will be completely covered by the couplings or fittings used. In addition, cut the lengths of the thread such that joints will become secure and wrench tight before conduit ends butt together in couplings and before conduit ends butt into the ends or shoulders of other fittings. Securely tighten threaded connections.
6. Keep bends and offsets in conduit runs to an absolute minimum. For the serving utilities, make large radius bends to meet their requirements. Replace deformed, flattened or kinked conduit.



7. Rigid metal conduit of 1-1/4-inch trade size or larger: Provide large radius factory-made bends or field bend the conduit with a power bender designed for the purpose and utilizing bend forms sized for the conduit being bent.
  8. Plastic Conduit: Apply heat for bends so that conduit does not distort or discolor. Use a spring mandrel as required ensuring full inside diameter at bends.
  9. Bend conduit to radius no less than Code required minimum.
  10. For conduits entering or leaving hazardous areas, provide each conduit at point of entry and exit from such areas with sealing inlets whether indicated on Drawings or not. Fill each inlet with approved sealing compound.
- G. Underground Conduits and Duct Banks: Make installation in accordance with Section 26 05 45.
- H. Conduit Stub-outs:
1. Unless otherwise indicated, all conduit stub-outs shall be minimum 4 or 5-inch as indicated in diameter and underground.
  2. Extend underground conduit stub-outs a minimum of 5-foot clear beyond building foundations, concrete walks, paving, other utilities and the like. Keep underground conduits a minimum of 10-foot clear of future building locations where indicated.
  3. Leave ends of underground stub-outs 6-inch clear of concrete envelope. Cap ends of steel conduit and wrap entire exposed portions with Scotchrap No. 50. Plug ends of nonmetallic conduit with Duxseal and cover with gravel and redwood planks for mechanical protection.
  4. Exact locations of stub-outs shall be indicated by a brass marker at finished grade and on Record Drawings.
- I. Conduit Stub-ups:
1. Use rigid steel conduit for stub-ups, 90-degree bends and risers to grade from other conduits. Stub-ups designated for future use shall be capped.
  2. Conduits stubbed up through concrete floors for connections to freestanding equipment shall be provided with a short elbow and an adjustable brass top or flush floor coupling set flush with the finished floor. Wiring shall be extended in rigid threaded conduit to the equipment, except that where required, flexible conduit to the equipment, except that where required, flexible conduit may be used 6-inch above the floor. Screwdriver-operated threaded flush plugs shall be installed in conduits from which no equipment connections are made. Use oil or grease on top of coupling and in threads on plug to prevent sticking.
  3. In utility rooms, electrical rooms, mechanical rooms and other unfinished areas not accessible to the public, terminate stub-ups to a minimum of 8-inch above floor unless otherwise indicated.

J. Empty Conduits:

1. Provide a nylon or polyethylene rope rated 250-lb tensile strength in each conduit more than 10-foot in length and left empty for future use. Not less than 10-inch of slack shall be left at end of the conduits.
2. Tag empty conduit at each accessible end identifying the purpose of the conduit and the location of the other end.
3. In wet, corrosive, outdoor or underground location, use brass, bronze or copper No. 16 gauge tags or lead tags secured to conduit ends with No. 16 or larger galvanized wire. Inscribe on the tags with steel punch dies clear and complete identifying information.
4. In dry interior locations use metal-rimmed paper tags securely affixed with nylon twine. Inscribe on the tags with India ink, clear and complete identifying information.
5. Unused conduit openings shall be plugged or capped with a suitable device designed for the purpose. Caulking compound shall not be used for plugging empty conduits.

3.4 PENETRATIONS

- A. General: Penetrations in walls, floors or ceilings requiring protected openings shall be fire-stopped. Fire-stopping shall be of an approved material, securely installed and capable of maintaining its integrity when subjected to the time-temperature curve of State Fire Marshal Standard 12-43-3 and Standard 12-43-1. Manufacturer's instructions shall be made available to the inspection authority and kept at the job site.

3.5 MEMBRANE PENETRATION

- A. General: Where penetration through membrane cannot be avoided, cut and re-seal membrane at point of penetration as required.

3.6 PAINTING AND FINISHING

- A. General: Paint all electrical equipment exposed to view in public areas with one coat of primer. Finish coat painting will be provided under Section 09900. For equipment inside electrical room, mechanical room and utility closets accessible only to authorized maintenance personnel, standard manufacturer's finishes are acceptable.

3.7 GROUNDING AND BONDING

- A. General:
1. Grounding systems use the following elements as grounding electrodes:
    - a. Underground metal cold water pipe

- b. Structural metal building frame
  - c. Concrete encased electrode (Ufer)
  - d. Ground rod (ground electrode)
2. Ground the neutral of each isolated AC or DC system having a neutral conductor with a system ground connection sized as indicated on the Drawings or per appropriate code requirement when not indicated. Ground clamps shall be readily accessible.
  3. Connection shall be made with exothermic connection or UL listed irreversible compression type grounding connector.
  4. Grounding System Resistance to ground shall be tested and shall not exceed 5-Ohm.
- B. Installation:
1. Install grounding and bonding conductors concealed from view.
  2. Install grounding well with cover at each ground rod location. Install ground well top cover flush with finished grade.
  3. Install 4/0 AWG bare copper wire in foundation footing. The Ufer ground grounding electrode shall consist of a 50-foot length of bare #4/0 copper wire extended its full length below ground level and embedded along the bottom of the concrete foundation footing which is in direct contact with the foundation earth and supported in such a manner that it cannot be less than 3 inches from the bottom or side of the concrete when the foundation concrete is poured.
  4. Install grounding electrode conductor and connect to reinforcing steel in foundation footing.
  5. Bond together metal siding not attached to grounded structure; bond to ground.
  6. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
  7. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, branch circuit panelboards, switch box and starter enclosures, motor frames, receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- C. Ground Electrode / Ground Well:

1. In the event that a metallic cold water pipe system is not available or should the grounding system to the cold water line not provide the proper ground resistance as specified, install single or multiple ground wells to obtain the proper resistance.
2. Locate ground rods a minimum of 6-foot apart or as indicated. Connect rods with minimum #3/0 AWG stranded, medium-hard drawn bare copper ground wires. Install ground wires 6-inch below slabs or 18-inch below finished grade, laid slack and in contact with earth throughout. Make buried tapes or splices by an exothermic welding process, "Cadweld" (by Erico) or Burndy "Thermoweld", and connect to the rods with Burndy type GK connectors.
3. Longer ground rods driven to a greater depth may be used in lieu of additional ground wells or in conjunction with other ground wells to attain the specified ground resistance.
4. Provide a white colored insulated copper conductor in a rigid steel conduit from the system grounding points to the grounding electrode in the ground well. Connect the conductor to the electrode with a 2 bolt "Evedur" clamp.

D. Equipment Ground:

1. Use the conduit system for equipment and enclosure grounding is not adequate, a separate ground wire of Code size is required.
2. Where nonmetallic conduits are used, provide a green color insulated copper ground conductor, of legal size, within the conduit and terminate properly to the equipment enclosures at each end. Enlarge size of conduit as required per applicable code(s).
3. Provide bonding devices, fittings or jumpers at expansion fittings or wherever continuity of grounding is not certain or where required by authorities having jurisdiction.
4. Provide, whether indicated on Drawings or not, each power feeder, single and multi-wire branch circuits (except those serving lights) with a separate green insulated ground wire, size as required by NEC, together in the circuit conduits and connect to the devices. Enlarge conduits where necessary to accommodate the ground wire. Conductor shield approved by conductor manufacturer may be used in lieu of a separate ground wire.

### 3.8 TESTS

- A. General: In addition to tests required by other sections, perform or cause to be performed in the presence of the Architect, all tests specified for electrical work when the work is substantially complete.
- B. Ground Resistance Test:

1. Employ a firm, qualified in such work, to measure resistance to grounding electrodes. Firm shall be approved by the Architect. Make tests before concrete is placed in affected areas in order that corrective measures, if required, may be taken.
  2. Test to demonstrate that the insulation resistance between phase conductors and ground to be not less than requirements of Title 24. All circuits shall be tested for neural connections.
  3. Test to demonstrate that the entire raceway, boxes and metallic enclosure system maintain electrical continuity and that the maximum resistance measured from any point on the system to a grounded point of reference does not exceed 5-Ohm.
  4. Submit to the Architect, a report showing the results of these measurements.
  5. If the resistances do not comply with the requirements of these Specifications, perform all corrective measures as directed by the Architect.
- C. Test of each duct for blockage or deformation after concrete has cured for 24 hours. Use a flexible mandrel/scrapper not less than 12-inch long with a diameter approximately 1/4-inch less than the inside diameter of the duct, pull a mandrel behind a stiff bristles brush.
1. Replace any duct section found blocked. Notify District Inspector 10 days before duct tests; submit written reports of tests to District Inspector.
- D. Service Voltage Test:
1. Measure the service voltages under no load and under maximum load conditions.
  2. Submit to the Architect, a report showing the results of these measurements.
  3. If, in the opinion of the Architect, the voltages regulation are not within acceptable limits make and complete arrangements with the utility company and/or other concerned agencies for proper electrical service.
- E. Operating Test: Upon completion of the work and adjustment of equipment, conduct an operating test and submit for approval at such time as the Architect directs. Conduct the test in the presence of the Architect and the District Inspector. Demonstrate systems and equipment to:
1. Operate in accordance with requirements of the Contract Documents.
  2. Be free from electrical and mechanical defects.
- F. Other Tests: Conduct all other and additional tests to assure the Architect that the electrical work is free from short circuits, grounds (ground faults) other than intentional grounds, and defective or damaged insulation. In additional, perform all tests that are required by authorities having jurisdiction or are requested by the Architect.

- G. Cost: All cost incurred, including required instruments and personnel for the tests shall be included on the bid price and paid for by the Contractor.

### 3.9 CLEANING

- A. General: Periodically remove waste and rubbish and maintain order. Clean and polish finished metal surfaces. Exposed materials, equipment and apparatus shall be thoroughly cleaned of dirt, rust, cement, plaster, etc., and have cracks and corners scraped out clean, and surfaces carefully cleaned of grease and oil spots and be left smooth and clean, with unfinished surfaces ready for painting. Clean grease, oil and other foreign substances from floors, walls, ceilings and fixtures, and leave premises clean and free from debris and unused construction materials, where caused by work under this Section. Completely clean insides of lighting fixtures removing dirt, bugs and other foreign substances.

### 3.10 COORDINATION

- A. General: Coordinate with each trade involved in the construction project. Work shall be fully laid out in advance, coordinating all features of construction, including control wiring between different systems.

### 3.11 QUALITY CONTROL

- A. General: Establish and maintain quality control for operations under this Section to ensure compliance with Contract requirements, and maintain records of quality control for all materials, equipment and construction operations.

### 3.12 INSPECTION

- A. Preparatory inspection shall be conducted prior to commencing work, as follows:
  1. Check to see that required shop drawings and other submittals have been made, are complete, and approved. Where exceptions have been taken to submittals, but approved subject to correction, check to verify that proper corrections have been made.
  2. Check materials and equipment upon delivery at job site for compliance with approved submittal. Verify for proper storage.
  3. Check layout drawings and details of interfaces with existing work, with interfaces and interrelations with work under other Divisions of the Specifications, and with interfaces with work performed.
  4. Check the actual conditions on the site for conformance with the above. Verify that conditions are ready for new work.
  5. Review installation procedures and code requirements with each person involved in inspecting and performing the work.

6. Review requirements of Drawings, Specifications, and the manufacturer's requirements and recommendations. In the event clarification or the Architect's decisions are required, such shall be obtained before proceeding with the work.
  7. Quiz personnel doing work to ensure their understanding of Contract requirements including workmanship and techniques.
  8. This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Architect and the District Inspector at any time upon request.
- B. Initial inspection shall be conducted when a representative sample of the work is complete, as follows:
1. Review the representative sample of the work against the Specification and code requirements previously discussed at preparatory inspection. Review shall include, but is not to be limited to:
    - a. Layout and sub-grade work.
    - b. Conduit/raceway installation.
    - c. Equipment installation.
    - d. Grounding.
    - e. Manholes, hand holes, junction boxes, enclosures, etc.
  2. Note and discuss deficiencies observed and corrective action to be taken. If corrective action is to be taken, an additional inspection shall be conducted for compliance.
  3. This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Architect or the District Inspector at any time upon request.
    - a. Follow-up inspections shall be conducted daily to ensure compliance with corrections required by initial inspection, as follows:
      - b. Check completed work against corrected representative sample of work.
      - c. Perform tests required by Contract to ensure compliance.
  4. This inspection and the results thereof shall be recorded. Inspection records shall be made available for review by the Architect or the District Inspector at any time upon request.
- C. Copies: Furnish the Architect a copy of these records and tests, as well as records of corrective action taken.

END OF SECTION 260500

**SECTION 26 05 45**  
**UNDERGROUND DUCTS AND RACEWAY FOR ELECTRICAL AND COMMUNICATION SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work Included: Provide all labor, material, equipment, necessary testing, and complete the power and service distribution system as shown on the Drawings and as specified herein.
- B. This Section includes the following:
  - 1. Conduit, ducts, and duct accessories for concrete-encased duct banks.
  - 2. Handholes and pull-boxes.
  - 3. Manholes.

**1.2 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Duct-bank materials, including separators and miscellaneous components.
  - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  - 3. Accessories for manholes, handholes, pull-boxes.
  - 4. Warning tape.
  - 5. Warning planks.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
  - 1. Duct entry provisions, including locations and duct sizes.
  - 2. Reinforcement details.
  - 3. Frame and cover design and manhole frame support rings.
  - 4. Ladder details.
  - 5. Grounding details.
  - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.



7. Joint details.
- 
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
    1. Duct entry provisions, including locations and duct sizes.
    2. Cover design.
    3. Grounding details.
    4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
  - D. Product Certificates: For concrete and steel used in precast concrete manholes, as required by ASTM C 858.
  - E. Qualification Data: For professional engineer and testing agency.
  - F. Source quality-control test reports.
  - G. Field quality-control test reports. QUALITY ASSURANCE
    1. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
    2. Comply with ANSI C2.
    3. Comply with NFPA 70.

### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.
- B. Store precast concrete underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

### 1.4 PROJECT CONDITIONS

- C. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of electrical service.

2. Do not proceed with interruption of electrical service without Construction Manager's written permission.

## 1.5 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect.

## PART 2 - PRODUCTS

### 2.1 CONCRETE PULL BOXES/MANHOLES

- D. General:
  1. Provide pre-cast concrete pull boxes where pull boxes are indicated complete with cover, drain hole, removable steel ladder, four pull irons, ground bus and ground rods. Pull box/manhole size shall be as indicated.
  2. Pre-cast concrete manholes shall conform to the requirements of ASTM C478 – Standard Specification for Pre-cast Reinforced Concrete Manhole
  3. Pull box/manhole shall meet all legal requirements as to size for conduits terminating therein.
  4. Reinforced concrete shall be Class A, 20,684 kPa (3,000 psi) type. Minimum design loading shall be 300 lb. Per sq. ft.
  5. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.

Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

    - a. Type and size shall match fittings to duct or conduit to be terminated.
    - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
  6. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
  7. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

- E. Covers:
1. Covers shall be concrete with a cast-iron lid and frame. Minimum clear opening through the frame shall be 36 inches in diameter.
  2. Cast-iron lid shall have lid lettering designation; "ELECTRIC", "HIGH-VOLTAGE", for Power Manhole/Pull box and "SIGNALS" for Communication pull boxes. Submit to the Architect for review.
  3. Provide traffic-type construction with traffic covers in areas involving vehicular traffic suitable for AASHTO HS-20 wheel loads.
- F. Accessories:
1. Provide hooked manhole ladder that complies with OSHA 29 CFR 1910.27 and ANSI A14.36 – Safety Code for Fixed Ladders. Ladder shall be coated with non-corrosive finish.
  2. Provide heavy duty cable racks and arms by Hubbell Power Systems/Chance Group for each manhole.
  3. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- G. Acceptable Manufacturers: Pre-cast concrete pull boxes shall be Quikset EPB-2100 Series or equal by Oldcastle Pre-cast Group or Brooks Jensen Pre-cast.

## 2.2 UNDERGROUND CONDUIT SYSTEM

- H. Underground Conduit System: Provide as shown on the Drawings and as specified.
- I. Excavation: Provide excavation for underground conduit system and manholes as shown on the Drawings and as specified hereinbefore.
- J. Conduit for the underground conduit system shall be as shown on the Drawings, and as specified in Section 260500 and in Part Three of this Section.
- K. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4" (0.6 cm) in a 10'-0" (3.1 m) length.
- L. Conduit fittings shall be UL approved and shall conform to applicable standards, except that where NEMA Standards for conduit fittings do not exist, fittings shall be as recommended by the conduit manufacturer.

- M. Conduit fittings shall be of a type especially made for use with the conduit for electrical service. Plastic conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight root-proof joint.

## PART 3 – EXECUTION

### 3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type -PVC, HDPE Schedule 40 in concrete-encased duct bank, unless otherwise indicated.
- B. Underground Ducts Crossing Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.
- C. All individual conduit and/or conduits that are grouped together to form a duct bank shall conform to all standards and to the requirements specified herein.
- D. Encase all underground conduits in concrete envelopes except for those allowed in this Specification.
- E. Duct bank or conduit shall have a minimum slope of 3" (7.6 cm) in each 100' (30.5 m) away from buildings and toward manholes and other necessary drainage points, and shall run in straight lines except where a change of direction is necessary.
- F. Changes in direction of runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature of 25' (7.6 m), except that manufactured bends may be used at ends of short runs of 100' (30.5 m) or less, and then only at or close to the end of the run. The long sweep bends may be made up of one or more curved or straight sections or combinations thereof. Manufactured bends shall have a minimum radius of 18" (46 cm) for use with ducts of less than 3" (7.6 cm) in diameter and a minimum radius of 36" (91 cm) for ducts of 3" (7.6 cm) in diameter and larger.
- G. Conduits shall terminate in end-bells where duct lines enter pull box/manholes.
- H. Separators used in duct banks shall be of pre-cast concrete, high impact polystyrene steel, or any combination of these and shall be placed not less than 4' (1.2 m) apart.
- I. Joints of the conduit runs shall be staggered not less than 6" (15 cm) in rows and tiers (layers) so as to provide a duct line having the maximum strength.
- J. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand, and dirt by means of suitable conduit plugs. As each section of a duct line is complete from manhole (hand hole) to manhole (hand hole), a testing mandrel not less than 12" (30.5 cm) long with a diameter 1/4" (0.6 cm) less than the size of the conduit shall be drawn through each conduit, after which a brush with stiff bristles shall

be drawn through until the conduit is clear of all particles of earth, sand, or gravel; conduit plugs shall then be immediately installed.

K. Underground duct banks encased in concrete shall comply with all applicable requirements of the specifications and the following:

1. Underground duct banks shall be of individual conduits encased in concrete. Except where rigid metallic conduit is indicated or specified, the conduit shall be PVC Schedule 40.
2. Unless indicated or specified otherwise, the kind of conduit used shall not be mixed in any one duct bank and shall not be smaller than 4" (10 cm) inside diameter, unless specified otherwise.
3. The top of the concrete envelope shall not be less than 24" (61 cm) below grade, except that under railroad tracks not less than 36" (91 cm) below grade.
4. Duct banks shall be rectangular in cross-section. The concrete encasement surrounding the ducts shall have a minimum concrete thickness of 3" (76.2 mm). Conduits shall be separated by a minimum concrete thickness of 3" (7.6 cm), except that light and power conduits shall be separated from control, signal, and telephone conduits by a minimum concrete thickness of 6" (15 cm).
5. The concrete shall be as herein specified and have a compressive strength of not less than 211 kg/sq. cm (20,684 kPa) (3,000 psi). Concrete used in the construction of the duct banks shall be in accordance with Division 3.

L. Underground conduit without concrete encasement shall comply with all applicable requirements of the Specifications and the following:

1. Concrete encasement may be omitted for conduits located below slabs on grade within buildings or where indicated in landscaped areas or in unpaved areas not subject to vehicular traffic or where specifically indicated as not required.
2. Conduits without concrete encasement shall be galvanized rigid steel or rigid plastic, minimum 4" (10 cm) inside diameter unless otherwise indicated.
3. The top of conduits shall not be less than 24" (61 cm) below grade. Separation of conduits shall comply with requirements as specified for underground duct lines encased in concrete.
4. There shall be not less than 3" (7.6 cm) clearance from the conduit to each side of the trench. The bottom of trenches shall be graded carefully and shall be smooth; where rock, soft spots, and/or sharp edged materials are encountered, the bottom shall be excavated for an additional 3" (7.6 cm) and filled and tamped level with

the original bottom with sand or earth free from particles that would be retained on a 1/2" (1 cm) sieve.

5. Under roads, paved areas, areas subject to vehicular traffic and railroad tracks, conduits shall be encased in concrete and installed as specified for underground duct lines encased in concrete. The concrete encasement shall extend not less than 5' (1.5 m) beyond the edge of paved areas and roads, and 12' (3.5 m) beyond the outer rails of railroad tracks.
  6. When specified, conduits to be installed under existing paved areas, roads, areas subject to vehicular traffic and railroad tracks which are not to be disturbed shall be zinc-coated, rigid steel, jacked into place. Identification slabs (markers), back filling, and reconditioning of surface shall be as herein specified. The kind of conduit used shall not be mixed in any one duct bank.
- M. Where corrosive soils are indicated on Drawings or encountered in field, rigid steel conduits, if used, shall be wrapped with Scotchwrap No. 50 tapes with a 30-percent tape overlap or encased in a minimum 3" concrete encasement using Type I or II cement. If concrete encasement is used, then other requirements for concrete duct banks shall apply.
- N. An AWG No. 4/0 bare stranded copper ground wire shall be laid on top of each underground duct bank (applicable for MV Feeders) and extended into each manhole and clamped to the ground rod with a cast type grounding lug designed for the purpose, or bound with exothermic weld.
- O. Duct-bank markers shall be located at the ends of all duct banks except at manholes, at approximately every 200' (61 m) along the duct run, and at each change in direction of the duct run. Markers shall be placed approximately 2' (61 cm) to the right of the duct bank when facing the longitudinal axis of the run and in the direction of the electrical load. Markers shall be made of class B concrete, 6" (15 cm) square or round section by 3' (91 cm) long. The top edges of the marker shall have a 1/2" (1 cm) chamfer all around. The letter "D" with two arrows shall be impressed or cast on the top of the marker. One arrow shall be located below the letter and shall point toward the duct bank. The second arrow shall be located adjacent to the letter and shall point in a direction parallel to the duct bank.
- P. A pull line such as "Poly Rope" shall be provided in each empty duct.
- Q. All utility conduit runs outside of building, including stub-outs on the site, shall be marked on the Record Drawings, identified and dimensioned exactly from a referenced building signed by the Contractor and countersigned by the Owner's Representative.

### 3.2 CONCRETE PULL BOX INSTALLATION

- A. Install pull boxes in paved areas wherever possible but keep each box a minimum of 1' (30.5 cm) clear of edge of paving. Tops of boxes shall align exactly with top surfaces of

paving. In other locations, install boxes where runoff water will not drain to the box and set top of box 2" (5 cm) above finished grade of surrounding earth.

- B. Except where indicated or where absolutely necessary, make no splices in concrete pull boxes. Where conductors of 600 volt rating or below must be spliced, use in-line or straight-through type with a heat shrinkable plastic sleeve placed over the splice. Coat the splice thoroughly with Skotchkote Electric Coating.
- C. Where different systems share the same pull box, provide transite barriers or other means to provide legal separations. Junction boxes inside concrete pull boxes shall be cast type with threaded hubs and gasketed covers.
- D. Immediately below the drain hole in the pull box, install a 12" (30.5 cm) diameter by 4' (1.22 m) long clay pipe, or concrete pipe, and fill with 1/2" (1 cm) size crushed rock.
- E. Coat entire below-grade exterior surfaces with an approved waterproofing compound.
- F. Verify and provide per local utility companies' requirements, where pull boxes, manholes and transformer pads indicated on Drawings are intended for local utility companies' usage.

### 3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 Section "Earthwork," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- G. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- H. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top-soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 2 Sections "Landscape Planting" and "Plant Maintenance."
- I. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 2 Section "Selective Site Demolition."

### 3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches on center for 5-inch ducts, and vary proportionately for other duct sizes
  - 1 Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
  - 2 Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Result for Electrical."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf-test nylon cord in ducts, including spares.
- H. Concrete-Encased Ducts: Support ducts on duct separators.
  - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written



recommendations, or use other specific measures to prevent expansion-contraction damage.

- b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
7. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
8. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

### 3.5 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

#### A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or

gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and traffic ways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below the frost line, below grade.
4. Handhole Covers: In paved areas and traffic ways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

E. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Division 7 Section "Elastomeric Sheet Waterproofing." After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

F. Damp-proofing: Apply damp-proofing to exterior surfaces of manholes after concrete has cured at least three days. Damp-proofing materials and installation are specified in Division 7 Section "Bituminous Damp-proofing." After ducts have been connected and grouted, and before backfilling, damp-proof joints and connections and touch up abrasions and scars. Damp-proof exterior of manhole chimneys after mortar has cured at least three days.

G. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

- H. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- I. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- J. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

### 3.5 GROUNDING

- A. Ground underground ducts and utility structures according to Section 26 05 00 under Part 3.7 - Grounding and Bonding.

### 3.6 FIELD QUALITY CONTROL

- J. Perform the following tests and inspections and prepare test reports:
  1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
  2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
  3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

### 3.7 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 45

**SECTION 26 05 53**  
**IDENTIFICATION OF ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
1. Identification for conductors and communication and control cable.
  2. Warning labels and signs.
  3. Equipment identification labels.

**1.2 RELATED SECTIONS:**

1. Section 260573 OPD Coordination Study/Arc Flash Analysis

**PART 2 - PRODUCTS**

**2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS**

- A. Marker Tape: Vinyl or vinyl -cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

**2.2 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-adhesive General Safety Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- D. Fasteners for Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.
- E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Dimension in first subparagraph below is clear space prescribed in NFPA 70 (2017 Edition), Table 110-26(A)(1), for equipment with nominal voltage to ground of 151 to 600 V, and with grounded parts, including concrete, brick, or tile walls, opposite the equipment. Additional clear space is required at this voltage if there are unguarded exposed live parts on both sides of the workspace. Retain below and revise to suit Project conditions or requirements of authorities having jurisdiction, or indicate varying clearance requirements on Drawings.
3. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES WIDE (PARALEL TO EQUIPMENT) AND CLEAR DEPTH REQUIRED IN ACCORDANCE WITH NEC ARTICLE 110.32
4. Equipment containing or operating circuits more than 240Volts nominal: Provide laminated plastic warning signs engraved in 1/2" high by 3/8" wide white letters on red background to read: "CAUTION HIGH VOLTAGE-'XXX' VOLT" , 'XXX' indicating actual voltage.
5. Provide Arc Flash Information Label with PPE category information on each electrical equipment, which are likely require examination, adjustment, servicing, or maintenance while energized, including but not limited to Switchgear, Switchboards, Transformers, Industrial Control Panels, Motor Control Centers, Disconnect Switches and Panels. PPE level shall be in accordance with the Arc Flash Hazard Analysis report done on the Short Circuit and Over-current Protective Device Coordination study
6. Arc Flash Information Label must contain the following important elements:
  - a. "Arc Flash Information" banner on top of Label.
  - b. Location / Equipment Designation.
  - c. Nominal System Voltage
  - d. Arc Flash Boundary Distance
  - e. Incident Energy cal/cm2 and Working Distance
  - f. Shock hazard when cover is open
  - g. Limited approach distance
  - h. Arc Flash PPE Hazard Category and Arc Rated of Clothing
  - i. Arc Flash Analysis Study number
  - j. Registered Professional Engineer performing the studies and date.
7. Arc Flash Label shall be supplied by Switchgear Factory, samples shall be included in the scope of Short-circuit and Protective Device Coordination and Arc Flash Hazard Analysis Studies.

## 2.3 EQUIPMENT IDENTIFICATION LABELS

- A. Provide laminated plastic warning signs engraved in 1/2" high by 3/8" wide white letters on red background to Provide laminated plastic warning signs engraved in 1/2" high by 3/8" wide white letters on red background to Provide laminated plastic warning signs engraved in 1/2" high by 3/8" wide white letters on red background to Retain one of two paragraphs below to specify type of labels Contractor must use to comply with NFPA 70 (2017 Edition), Article 110-22, "Identification of Disconnecting Means." Note that, unless otherwise indicated, the labeling products selected below will also be used for labeling that is not required by NFPA 70 but may be specified in Part 3 "Application" Article to identify equipment other than disconnect devices. See Evaluations.
- B. Provide three layers laminated plastic (micarta) nameplates engraved in 1/4" (minimum) high white letters on black background to correspond with the designations on the Drawings, electrical equipment nameplate shall be as follows:
- C. The main nameplate shall give the equipment designation in 1/2" high letters, the second line in 1/4" high letters shall indicate the Amperage, Voltage-Phase, and Wire. The third line of same dimensions as the second line shall indicate where the equipment fed from. Following is an example of Panelboard nameplate:

PANEL "1HA"  
100A MAIN, 480Y/277-VOLT, 3-PH, 4W  
FED FM "1MS" – 100A CB

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Auxiliary Electrical Systems Conductor and Cable Identification: Use marker tape to identify field-installed alarm, control, signal, sound, intercommunications, voice, and data wiring connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and cable pull points. Identify by system and circuit designation.
  - 2. Use system of designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
- B. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply metal-backed, butyrate warning signs. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

- a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- C. Equipment Identification Labels (name plates): On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Provide laminated plastic nameplates engraved in white letters on black background (for emergency power equipment, provide white letters on red background), attached with rivets or self tapping screws or with nuts and flat and lock washers.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label, drilled for screw attachment.
    - c. Elevated Components: Increase sizes of labels and legend to those appropriate for viewing from the floor.
    - d. Provide engraved branch circuit breaker numbering strip, screw or riveted on branch circuit and lighting panelboard internal trim. Permanent engraved numbering on internal trim is acceptable, sticker numbering system is not permitted.
    - e. Provide load schedules for all branch circuit and lighting panelboards, identifying type, size and location of load. Schedules shall be typewritten and protected by transparent plastic cover.
  - 2. Equipment to be Labeled:
    - a. Identification labeling of some items listed below may be required by individual Sections or by NFPA 70.
    - b. Panelboards, electrical cabinets, and enclosures.
    - c. Electrical switchgear and switchboards.
    - d. Transformers.
    - e. Motor-control centers.
    - f. Disconnect switches.
    - g. Enclosed circuit breakers.
    - h. Motor starters.

- i. Push-button stations.
- j. Power transfer equipment/MV Switches.
- k. Contactors.
- l. Pull boxes.
- m. Terminal Cabinet

END OF SECTION 26 05 53



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**SECTION 26 05 73**  
**OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY/ARC FLASH**  
**HAZARD ANALYSIS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes short circuit and protective device coordination study encompassing portions of electrical distribution system from normal power source or sources up to and including breakers in service entrance switchboard, fuses in service entrance switchboard, main breaker in sub-distribution panels, fuses in sub-distribution panels and main breaker in each panelboard.
1. The contractor shall furnish short circuit and protective device study prepared by electrical equipment manufacturer for the protective devices to be installed under this project to assure proper equipment and personnel protection.
  2. The study shall present an organized time-current analysis of each protective device in series from individual device back to the normal power source.
  3. The study shall include an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The Arc Flash Hazard Analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.

**1.2 REFERENCES**

- A. Institute of Electrical and Electronics Engineers:
1. IEEE 241 – Recommended Practice for Electric Power Systems in Commercial Buildings (Gray Book).
  2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems (Buff Book).
  3. IEEE 399 – Recommended Practice for Industrial and Commercial Power System Analysis (Brown Book).
  4. IEEE 1015 – Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.
  5. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
- B. American National Standard Institute (ANSI):
1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
  2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures.

3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
  4. ANSI C 37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.
- C. National Fire Protection Association:
1. NFPA 70 - National Electrical Code.
  2. NFPA 70E – Standard for Electrical Safety in the Workplace.

### 1.3 DESIGN REQUIREMENTS

- A. Complete Short Circuit and Protective Device Coordination Study to meet requirements of NFPA 70.
- B. Complete an Arc Flash Hazard Analysis Study per the requirements set forth in NFPA 70E – Standard for Electrical Safety in the Workplace. The Arc Flash Hazard Analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- C. Report Preparation:
1. Prepare study prior to ordering distribution equipment to verify equipment ratings required.
  2. Perform study with aid of computer software program.
  3. Obtain actual settings for packaged chiller and motor characteristics and for equipment incorporated into Work.
  4. Calculate short circuit interrupting and, when applicable, momentary duties for assumed 3-phase bolted fault short circuit current and phase to ground fault short circuit current at each of the following:
    - a. Electrical Utility supply termination point.
    - b. Automatic transfer switch.
    - c. Engine generator.
    - d. Main Service Switchboard.
    - e. Distribution panelboards.
    - f. Branch circuit panelboards.
    - g. Each other significant equipment location throughout system.
- D. Report Contents:
1. Include the following:

- a. Executive Summary.
- b. Descriptions, purpose, basis and scope of study.
- c. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties.
- d. Protective device time versus current coordination curves, tabulation of relay and circuit breaker trip unit settings and fuse selection.
- e. Fault current calculations including definition of terms and guide for interpretation of the computer printout.
- f. Details of incident energy and flash protection boundary calculations.
- g. One-line diagram revised by adding actual instantaneous short circuits available.
- h. State conclusions and recommendations for system improvements, where needed.

#### 1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with IEEE 242 and IEEE 1584.
- B. Studies shall be performed using the latest revision of the SKM System Analysis Power Tools for Windows (PTW) software program. Submit for review information on alternative equal software proposed to be used in performing study.
- C. Maintain one copy of each document on site.

#### 1.5 QUALIFICATIONS

- A. Study Preparer: Electrical equipment manufacturer Engineering Services specializing in performing work of this section with minimum five years documented experience and having completed projects of similar size and complexity within the past years.
- B. Perform study under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location in State of with minimum of five years experience in power system analysis.
- C. The Registered Professional Electrical Engineer shall be a full time employee of the equipment manufacturer or an approved engineering firm by the equipment manufacturer.
- D. The equipment manufacturer or approved engineering firm shall demonstrate experience with Arc Flash Hazard Analysis by submitting names of at least ten actual Arc Flash Hazard Analysis it has performed in the past year.
- E. Demonstrate company performing study has capability and experience to provide assistance during system start up.

## PART 2 - PRODUCTS

### 2.1 STUDIES

- A. Contractor to furnish short-circuit and protective device coordination studies as prepared by equipment manufacturer engineering services department.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.
- C. Provide related Equipment Warning labels and Signs under "IDENTIFICATION OF ELECTRICAL SYSTEMS" Section.

### 2.2 DATA COLLECTION

- A. Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.
- B. Source combination may include present and future motors and generators.
- C. Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner, or Contractor.
- D. If applicable, include fault contribution of existing motors in the study. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

### 2.3 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standard 141-1993.
- B. Transformer design impedances shall be used when test impedances are not available.
- C. Provide the following:
  - 1. Calculation methods and assumptions
  - 2. Selected base per unit quantities
  - 3. One-line diagram of the system being evaluated
  - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
  - 5. Tabulations of calculated quantities

6. Results, conclusions, and recommendations.
- D. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:
1. Electric utility's supply termination point
  2. Main Service Switchboard.
  3. Motor control centers
  4. Standby generator and automatic transfer switch
  5. Branch circuit panelboards
  6. Other significant locations throughout the system.
- E. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to short circuit ratings
  2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses.
  3. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

#### 2.4 PROTECTIVE DEVICE COORDINATION STUDY.

- A. Proposed protective device coordination time-current curves (TCC) shall be displayed on log-log scale graphs.
- B. Include on each TCC graph, a complete title and one-line diagram with legend identifying the specific portion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
- D. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the following characteristics on the TCC graphs, where applicable:
  1. Electric utility's overcurrent protective device
  2. Medium voltage equipment overcurrent relays
  3. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands

4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
  5. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves
  6. Conductor damage curves
  7. Ground fault protective devices, as applicable
  8. Pertinent motor starting characteristics and motor damage points, where applicable
  9. Pertinent generator short-circuit decrement curve and generator damage point
  10. The largest feeder circuit breaker in each motor control center and applicable panelboard.
- F. Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

## 2.5 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.
- B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.
- C. The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA where work could be performed on energized parts.
- D. Safe working distances shall be based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm<sup>2</sup>.
- E. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations
- F. The short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all

motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration the parallel operation of synchronous generators with the electric utility, where applicable.

- G. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond 3-5 cycles.
  - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g. contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).
- H. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.
- I. When performing incident energy calculations on the line side of a main breaker (as required per above), the line side and load side contributions must be included in the fault calculation.
- J. Mis-coordination should be checked amongst all devices within the branch containing the immediate protective device upstream of the calculation location and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.
- K. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584-2002 section B.1.2. Where it is not physically possible to move outside of the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

## PART 3 - EXECUTION

### 3.1 FIELD QUALITY CONTROL

- A. Provide assistance to electrical distribution system equipment manufacturer during start up of electrical system and equipment.



- B. Select each primary protective device for delta-wye connected transformer so device's characteristic or operating band is within transformer characteristics, including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection.
- C. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by 16 percent current margin to provide proper coordination and protection in event of secondary line-to-line faults.
- D. Separate medium-voltage relay characteristic curves from curves for other devices by at least 0.4 second time margin.

### 3.2 ADJUSTING

- A. Perform field adjustments of protective devices and modifications to equipment to place equipment in final operating condition. Adjust relay and protective device settings in accordance with recommended settings table on the approved short circuit and protective device coordination study.

### 3.3 ARC FLASH WARNING LABELS

- A. The contractor of the Arc Flash Hazard Analysis shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. All labels will be based on recommended overcurrent device settings and will be provided after the results of the analysis have been presented to the owner and after any system changes, upgrades or modifications have been incorporated in the system.
- C. Arc Flash Label must contain important elements as required in the NFPA 70 and NFPA 70E, and further detailed in Section 260553.
- D. Labels shall be machine printed, with no field markings.
- E. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.
  - 1. For each 600, 480 and applicable 208 volt panelboard, one arc flash label shall be provided.
  - 2. For each low voltage switchboard, one arc flash label shall be provided.

END OF SECTION 26 05 73

**SECTION 26 24 00**  
**BUILDING SERVICE & DISTRIBUTION**

**PART 1 - STANDARDS**

**1.1 DESCRIPTION**

- A. Work Included: Provide all labor, material, equipment, necessary testing, and complete the building service and distribution system as shown on the Drawings and as specified herein.

**PART 2 - MATERIALS**

**2.1 CONCRETE PULL BOXES**

- A. General:
1. Provide precast concrete pull boxes where pull boxes are indicated complete with cover, drain hole and two pull irons. Unless otherwise indicated, inside dimensions for pull boxes shall be 2'-6" (0.762 m) wide by 4' (1.22 m) long by 4' (1.22 m) deep.
  2. Pull boxes shall meet all legal requirements as to size for conduits terminating therein.
  3. Reinforced concrete shall be Class A, 20,684 kPa (3,000 psi) type.
- B. Covers:
1. Covers shall be concrete with a cast-iron lid and frame.
  2. Cast-iron lid shall have bead weld designation; "ELECTRICAL", "FIRE", "COMMUNICATIONS", "DATA", "FIBER-OPTIC" and etc., as required. Submit to the Architect for review.
  3. Provide traffic-type construction with traffic covers in areas involving vehicular traffic.
- C. Acceptable Manufacturers: Pre-cast concrete pull boxes shall be Quikset EPB-2100 Series or equal by Brooks Products, Jensen or Oldcastle.

**2.2 UNDERGROUND CONDUIT SYSTEM**

- A. Underground Conduit System: Provide as shown on the Drawings and as specified.
- B. Excavation: Provide excavation for underground conduit system and manholes as shown on the Drawings and as specified hereinbefore.

- C. Conduit for the underground conduit system shall be as shown on the Drawings, and as specified in Section 260500.
- D. The conduit length for each size shall be the length that is standard with the manufacturer with a permissible tolerance of 1/4" (0.6 cm) in a 10'-0" (3.1 m) length.
- E. Conduit fittings shall be UL approved and shall conform to applicable standards, except that where NEMA Standards for conduit fittings do not exist, fittings shall be as recommended by the conduit manufacturer.
- F. Conduit fittings shall be of a type especially made for use with the conduit for electrical service. Plastic conduit and fittings shall be capable of being joined, by means of a solvent welding cement, so as to provide a watertight root-proof joint.

## 2.3 CABLES

- A. General: Provide all cables as indicated and specified.
- B. 600-Volt Class and Under: Provide conductors of the 600-Volt class and under as specified under paragraph, "Wire and Cable", in Section 26 05 00.
- C. Auxiliary Systems: Provide clock, voice/data, security, fire alarm or other auxiliary type system cables as specified under the respective sections.

## 2.4 TRANSFORMERS (600-VOLT CLASS AND BELOW)

- A. General: Provide transformers for use on 60-Hertz system with the following characteristics:
  1. Type: Dry, ventilated, self-cooled type with provisions for future cooling fans where indicated.
  2. Complying with DOE 10 CFR 431 (78 FR 2335 – April 18, 2016)
  3. Ratings: Phase, voltage and connection arrangement as indicated.
  4. Capacities: The kVA capacities as indicated with capability of carrying a continuous 10-percent overload at rated voltage without exceeding NEMA average and hot spot temperature ratings of the insulation at 104-degree F (40-degree C) ambient air temperature.
  5. Windings: Constructed of copper and shall be of the fire-resistant type, designed for natural convection cooling through normal air circulation.
  6. Insulation Class H (Class 220 Insulation Rating) 150-degree C average winding temperature rise.
  7. Dimensions: Within the limitations indicated or the space available for installing the transformers.

8. Taps: Four 2-1/2 percent primary taps, 2 above and 2 below rated voltage.
  9. Terminals: Locate terminals at the bottom of the transformer or other area where the temperature, when operating at 10-percent overload and in an ambient of 104-degree F (40-degree C) will not exceed 140-degree F (60-degree C).
  10. Mounting: Floor, wall or ceiling mounted, as indicated. Transformers shall be furnished complete with mounting channels and mounting bolts. Enclosures shall be provided with lifting lugs and jacking plates as required.
  11. Vibration Dampening: Constructed with built in vibration dampeners which completely isolate the cores and coils from all supports and enclosures.
  12. Sound Ratings: In the installed condition, the sound levels shall not exceed:
    - a. 45 dB for 0 to 45 kVA.
    - b. 50 dB for 46 to 150 kVA.
    - c. 55 dB for 151 to 300 kVA.
    - d. 60 dB for 301 to 500 kVA.
  13. Enclosure: Cover plates shall be Code-gauge sheet steel, captive type, bolted to the enclosure framework. Enclosure shall have suitable ventilating openings with rodent-proof screens. Provide weatherproof type when located outdoors.
  14. Finish: Metal parts excepting cores or core mounting frames shall be cleaned, rust-proofed, and be given a heavy coating of an inert primer. Cover plates and external metal parts shall be finished with two full-bodied coatings of oil-resistant industrial gray enamel.
  15. Nameplates: Provide nameplates, identifying the characteristics, as specified in Section 26 05 00.
- B. Acceptable Manufacturers: Transformers shall be manufactured by Square D; Eaton, Siemens, or General Electric.

## 2.5 PANELBOARDS

- A. General:
1. Provide flush or surface mounted panelboards with main breakers or lugs, sub-fed lugs, bus size and circuit breakers of a rating as shown on the Drawings.
  2. Each branch circuit breaker shall be identified by permanent number identification as to circuit numbers. Adhesive sticker numbering identification system is not acceptable.
  3. Panelboard shall have "field marked" to warn qualified persons of the potential for arc-flash hazards.
  4. Top of panelboard shall not be higher than 78" (198 cm) above finished floor.

5. Space for controls such as time clocks, time controlled relays and air-conditioning controls shall be located in a separate compartment with hinged doors within respective panelboards. Where limited by the height of the panels, locate controls in a separate cabinet adjacent to the respective panelboard.
- B. Bus bars shall be rectangular in cross-section constructed of copper with silver-plated joints and interconnections. Unless otherwise indicated, neutral buses shall be full size. Bus bars shall be isolated from wiring troughs and working spaces and be braced to withstand a minimum short circuit fault of 25,000 amperes rms symmetrical or larger as indicated. Provide split bus where indicated on the Drawings.
- C. Circuit Breakers:
1. Circuit breakers shall have interrupting capacities as indicated on the Drawings. Minimum interrupting capacities for 120/208 and 277/480-volt circuit breakers shall be 10,000 amperes and 14,000 amperes rms symmetrical respectively. Provide breakers of the bolt-on molded case type. Plug-in types are not acceptable.
  2. Single-pole breakers shall be full module size; two poles shall not be installed in a single module. Multi-pole circuit breakers shall be of the common-trip type having a single operating handle and for sizes of 50 amperes or less, may consist of single-pole circuit breakers permanently assembled at the factory into a multi-pole unit.
  3. Circuit breakers used for motor-circuit disconnects and not within sight of the motor controller shall be capable of being locked in the open position.
  4. All circuit breakers shall have provisions for lock out clips which shall be provided for breakers serving motors, signal systems and air-conditioning controls, and as indicated on the schedules on the Drawings.
  5. Provide approved "Lock-Off" devices for all circuit breakers serving lighting circuits without local switching.
  6. Circuit breakers shall be arranged in the panels to correspond exactly with the schedules on the Drawings. Circuit numbers shall be black-on-white plastic tabs or other such permanent type which cannot be changed readily from the front of the panel.
  7. Breakers serving loads comprised of large wattage incandescent lamps shall be equipped with desensitized magnetic trip mechanisms which prevent tripping by in-rush currents.
  8. Provide approved handle ties for individual circuit breakers protecting each ungrounded branch circuit conductor of multi-wire branch circuits.
  9. Provide ground fault circuit-interrupter for all Code required lighting or receptacle circuits rated at 15, 20, 25 or 30 amperes at 120 volts or above. The bolt-on molded-case type circuit breaker, similar to General Electric Type THQB-GF, shall

be of the quick-make, quick-break operating mechanism with construction as described above and with the following additional features:

- a. Amperes line-to-line, ground fault conditions: 0.005.
  - b. Amperes, symmetrical rms at 120 volts: 10,000.
  - c. Push-to-test circuit.
  - d. Trip-free handle to allow breaker to trip even if handle is held or blocked in the "ON" position.
  - e. If the above requirements cannot be met, the following shall be provided:
    - 1) Provide ground fault circuit-interrupter for all Code required circuits. Ground-fault protection shall consist of a ground-sensor encircling all phase conductors, connected to a solid-state ground relay which initiates tripping of the circuit breaker.
    - 2) Ground protection shall be adjustable from 5 to 50 amperes. Circuit-interrupter shunt-trip and relay shall operate from a 120-volt control source. Time-current characteristic shall provide 0.1-second operation at about 10 times pickup. Relay shall be surface mounted in a separate barriered space.
- D. Control Devices: Contactors, relays, time switches and related equipment shall be as specified in Section 260500 and shall be mounted in a separate barriered space. Refer to the paragraph, "Cabinets", herein.
- E. Cabinets:
1. Back boxes shall be flush or surface mounted as shown on the Drawings. Construction shall be of Code gauge zinc-coated sheet steel bearing the UL label where required. Back boxes shall be galvanized when recess mounted. Refer to "Painting" section for finish requirement of galvanized surfaces.
  2. Panelboards shall be minimum 20" (51 cm) wide and shall be of types as required by the schedules and these Specifications. Where specifically indicated on the Drawings, provide UL listed column-type panelboards. All other requirements of the column-type panelboard shall comply with those specified in this section.
  3. Panelboard doors shall be hinged and have pin tumbler cylinder locks operated by paracentric type keys. All panelboard locks shall be common keyed. Furnish two keys for each panelboard.
  4. Where more than one door is mounted on a panelboard, arrange the trim so that a minimum 2" (5.1 cm) solid metal trim space is maintained between doors. Doors and trims shall be minimum 12 gauge steel.

5. Provide 12" (30.5 cm) high gutter where double lugs are required or where cable size exceeds bus size.
  6. Wiring gutters on panelboards having through feeders shall be 5" (12.7 cm) minimum. Gutters shall be an integral part of the panelboard.
  7. Provide barriered space for mounting contactors and control devices with a hinged door and lock, where shown or required.
- F. Finish: Doors, trims and surface mounted back boxes located in areas exposed to public view shall be painted with one coat zinc chromate and one coat of primer sealer. Finish painting shall be in accordance with section, "Painting". Provide doors, trims and surface mounted back boxes located in custodian's rooms, mechanical rooms, electrical rooms and other areas not exposed to public view with one coat zinc chromate and a hammertone or light gray baked enamel finish.
- G. Identification:
1. Provide neatly typed circuit index cards, clearly and correctly identifying all circuits, mounted in card holders, behind glass or heavy plastic on the inside of the panelboard doors. Indexes shall accurately record room numbers and load of each circuit.
  2. Provide nameplates as specified under paragraph, "Nameplates", in Section 260553. Designate the identifying nomenclature, voltage and phase of the panel as shown on the Drawings, for example:
 

PANEL "1LB"  
 100 A MAIN – 208Y/120 V, 3 PH, 4W  
 FED FM "1DSL" – 100A CB
- H. Acceptable Manufacturers: Panelboard assembly, devices and major components shall be of the same manufacturer. Acceptable manufacturers are Square D; Eaton, Siemens, or General Electric.

## 2.6 DISTRIBUTION SWITCHBOARDS

- A. General:
1. Provide distribution switchboards with ratings, components and features as indicated on the Drawings.
  2. Switchboards shall consist of molded case thermal magnetic circuit breakers or externally operable quick-make, quick-break fused switch as indicated on the Drawings, in floor-standing, dead front, totally metal enclosed sections requiring front access only.
  3. All sections shall be nominal 90" (22.9 cm) high, 15" (38.1 cm) deep and 38" (0.965 m) or 42" (1.067 m) wide and shall not exceed the physical spaces allowed

for on the Drawings. Switchboards shall be constructed of Code gauge sheet steel.

4. In outdoor locations or where indicated, provide weatherproof enclosure having doors with padlocking facilities.

B. Bus bars:

1. Bus bars shall be rectangular in cross-section, constructed of copper with silver-plated joints and full-height in each vertical section with horizontal cross bus bars between sections. Short circuit bracing capabilities shall be in accordance with the minimum requirement as indicated for the circuit breakers.
2. Provide all lugs for sizes No. 6 AWG or larger suitable for copper conductors. Shop drawings must show lug sizes based on the actual conductors to be provided.
3. Neutral bar shall have terminals for all active, spare or inactive circuits.

C. Disconnect Devices:

1. Circuit breakers shall be of the bolted-on molded case type, with thermal magnetic trips and shall be rated at the voltage with frame sizes, number of poles, and trip settings as shown on the Drawings. Multi-pole circuit breakers shall have a common operating handle.
2. Provide circuit breakers with interrupting capacity as indicated on plans, minimum interrupting capacity shall be 14,000 symmetrical rms amperes at 480/277 volts and 10,000 amperes at 208/120 volts.
3. Fusible switches shall be of the quick-made, quick-break, visible blade type and shall be UL listed and horsepower rated. Phase sequence and circuit numbering shall be uniform. Temperature rise and current carrying capacity of busses and parts shall be in accordance with NEMA Standards and NEC requirements. Provide fuses as specified under paragraph, "Fuses", in Section 26 05 00.
4. When indicated, provide circuit breakers and switches with shunt-trips, motor operators or other features as required for the application.
5. All circuit breakers shall be pad-lockable in the "OFF" position. All switches shall be pad-lockable in either the "OPEN" or "CLOSE" position.

D. Identification:

1. Nameplates: Provide nameplates and warning signs as specified, in Section 260553.
2. Provide a nameplate for each circuit breaker or fusible switch with wording to indicate load served.



3. The main nameplate shall give the switchboard designation in 1/2" (1.3 cm) high letters. A second line in 1/4" (0.6 cm) high letters shall indicate the Ampere, Voltage –Phase and Wire. The third line of same dimensions as the second line shall indicate where the equipment fed from.
- E. Finish: Supporting framework, cover plates and other metal surface shall first be given a phosphate coating for superior paint adhesion and corrosion resistance. Alkyd amine standard gray enamel shall be electrostatically applied and baked thoroughly in a convection-type oven to ensure a long lasting, mark resistant finish.
- F. Acceptable Manufacturers: Switchboard assembly, switches, circuit breakers, devices and major components shall be of the same manufacturer. Acceptable manufacturers are Square D, General Electric, Siemens, or Cutler Hammer.

## 2.7 DISTRIBUTION PANELBOARDS

- A. General: Distribution panelboards in general shall comply with the requirements of the distribution switchboards except that distribution panelboards shall be suitable for wall mounting instead of free floor standing.

END OF SECTION 26 24 00

## SECTION 262726

### WIRING DEVICES (DECORA)

#### PART 1 – GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to wiring devices specified herein.
- C. Related Sections:
  - 1. Division 01 Section “General Commissioning Requirements”, for commissioning procedures.

##### 1.2 DESCRIPTION OF WORK

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of Decora Style electrical wiring devices in this Section include the following:
  - 1. Receptacles.
  - 2. Ground-fault circuit interrupters.
  - 3. Switches.
  - 4. Wallplates.

##### 1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer’s Qualifications: Firm with at least two (2) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. CEC Compliance: Comply with CEC as applicable to installation and wiring of electrical wiring devices.
- D. UL Compliance: UL498, UL Fed Spec WC-596, UL20, UL Fed Spec WS896E where available.

## 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on electrical wiring devices.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include, but are not limited to, the following (for each type and rating of wiring device):
  1. Leviton Manufacturing Co. Inc.
  2. Arrow-Hart, Eaton.
  3. Pass & Seymour (Legrand)
  4. Harvey Hubbell Inc.
  5. Intermatic (timer switches).

### 2.2 FABRICATED WIRING DEVICES

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No. WD 1. Provide W-C-596 rated wiring devices where available for the device listed below. Provide white color devices except as otherwise indicated.
- B. Receptacles:
  1. All receptacles shall be the grounding type with ground connection made through an extra pole which shall be permanently connected to the green grounding conductor.
  2. Duplex receptacles for 20 Ampere, 120 Volt service shall be two-pole, three-wire rated 20 Amperes at 125 Volt.
  3. Single receptacles for 20 Ampere, 120 Volt service shall be two-pole, three-wire rated 20 Ampere at 125 Volt .
  4. Ground-fault Circuit Interrupters (GFCI) as required per-Code, shall be two-pole, three-wire rated 20 Ampere at 125 Volt.
  5. USB charging device shall be with the duplex receptacle for 20 Ampere, 120 Volt service, two-pole, three-wire rated 20 amperes at 125 volts.
  6. Style: Receptacles shall be Decora style nylon.
  7. Color: White (normal circuit) and Red (emergency circuit)
- C. Switches:

1. Snap: Provide decorator rocker switches, rated 20 amperes at 120/277 volts quiet type and shall be UL approved without derating for tungsten lamp loads or inductive loads.
2. Rotary spring wound timer switches: 0-60 minutes 20A. Inductive load rated.
3. Color: White unless otherwise noted.

## 2.3 WIRING DEVICE ACCESSORIES

- A. Wall plates: Provide wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which match wiring devices to which it attached. Wall plates shall be made of high-impact smooth nylon, or 304 stainless steel wall plate as indicated per-plan. Metal screws for securing plates to devices shall be as follows:
  1. Screw heads colored to match finish of plates.
  2. Finish: Brushed Stainless Steel.
- B. Manufacturers: Subject to compliance with requirements, manufacturers providing wallplates may be incorporated in the work include, but are not limited to, the following (for each type and rating of wiring device):
  1. Leviton Manufacturing Co. Inc.
  2. Arrow Hart, Eaton.
  3. Pass & Seymour (Legrand)
  4. Lutron Electronics, Inc.
  5. Harvey Hubbell Inc.

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF WIRING DEVICES

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of CEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Where receptacles are shown to be mounted of above counter, refer to Architectural Drawings for cabinet locations and mount receptacle box to clear backsplash of all counters by a minimum of two inches.
- C. Install device plates in full contact with wall surface or surface mounted box.
- D. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.

- E. Install wiring devices after wiring work is completed.
- F. Install wall plates after painting work is completed.
- G. Install GFCI receptacle as indicated per-plan, ground fault circuit interrupted duplex receptacle shall be individually ground fault protected unit (daisy chained installation of regular duplex receptacle protected by adjacent GFCI receptacle is not acceptable).
- H. Installed switched receptacle controlled by occupancy sensor, as indicated per-plan – switched receptacle shall have factory identified marking.

### 3.2 PROTECTION OF WALLPLATES AND RECEPTACLES:

- A. Upon installation of wall plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

### 3.3 GROUNDING:

- A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated. Wiring device grounding shall be bonded to equipment ground wire of the branch circuit serving device in its outlet box.

### 3.4 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short- circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 27 26

**SECTION 26 51 00  
LIGHTING SYSTEM**

**PART 1 - STANDARDS**

**1.1 DESCRIPTION**

- A. Principal Work Items are: Provide all labor, material, equipment, and testing necessary and complete the lighting system as shown on the Drawings and as specified herein.

**1.2 QUALITY ASSURANCE**

- A. Standards:
  - 1. Comply with standards listed in Section 260500 and the following:
    - a. Electrical Testing Laboratories, Inc. (ETL);
    - b. Certified Ballast Manufacturer (CBM).
- B. Qualifications of Installers: As specified in Section 260500.
- C. Qualifications of Manufacturers: As specified in Section 260500.

**PART 2 - MATERIALS**

**2.1 LIGHTING FIXTURES**

Provide complete luminaire assemblies with features, options, and accessories as scheduled.

- A. General: Provide recessed, surface, and pendant mounted lighting fixtures, complete with lamps, LED chips and driver, and ballasts where required, as shown, and as specified.
- B. Fixture Operating Voltages: 277-volt for fluorescent, LED and high intensity discharge lamps, unless otherwise indicated.
- C. Ceiling Construction: Verify the ceiling construction at each fixture and provide the proper trim and mounting accessories with all required frame and finish moldings or escutcheons and hardware for the actual type of ceiling and the specific fixture to provide a neat professional finish.
- D. Fixture catalog numbers:
  - 1. Catalog numbers indicated for recessed fixtures are usually for lay-in type ceiling installation. Verify the ceiling condition for each recessed fixture and provide

fixture complete with proper mounting accessories required for the ceiling condition in which the fixture is mounted.

2. For fluorescent fixtures, the catalog numbers indicated are those for individual units. Where continuous rows are indicated, provide all necessary mounting accessories.
  3. Where both catalog number and description, either narrative or pictorial are indicated, the requirements of the description shall take precedence and prevail.
- E. All fixtures of one type shall be of one manufacturer and of identical finish and appearance.
- F. Complete units and all electrical components for fluorescent, LED and special fixtures shall bear the U.L. and Electrical Testing Laboratory (ETL) labels. Labels shall not be placed on fixtures at locations where installation of unit labels is visible.

## 2.2 LED FIXTURES

- A. General requirements:
1. Product shall be in compliance with ANSI/UL 8750 Safety Standard for LED Lighting (NRTL Lab listed).
  2. Product shall be tested and UL listed for dry, damp or wet locations as applicable.
  3. Product shall be DesignLights Consortium qualified.
  4. LED fixture shall be spectrally and photometrically tested to IESNA LM-79 Standards. Full LM-79 reports shall be included in the shop drawing submittal.
  5. Performance warranty shall be min. 5 year, covering Lumen maintenance and color shift.
  6. The LED luminaires shall be lead-free, mercury-free and meet Restriction of Hazardous Substances (RoHS) regulations.
  7. Outdoor LED luminaires are International Dark-Sky Association (IDA) approved and are measured for performance using IESNA standards and guidelines.
  8. 0-10V LED driver shall comply to NEMA410 standard for mitigating inrush currents with solid state lighting sources.
- B. Performance Criteria:
1. LED chip/package shall be manufactured by a well known industry leaders (Cree, Nichia, Osram-Opto, LumiLEDs, Philip or approved equal).
  2. Product data shall include the delivered lumens, input wattage including driver, lumen per-watt/efficacy and optics, maximum ambient operating temperature, LM-80 lumen maintenance data, useful life to L70 (70% Lumen depreciation) and distribution characteristics.

3. Products shall have Energy Star Certified.

C. Manufacturer:

Bega, Cree, Eaton-Cooper Lighting, Canlet, Finelite, HE Williams, Isolite, Juno, Lithonia, Mark Architectural Lighting, NuLite, Phoenix, Prima, Rebelle, Spectrum, Visionaire, XAL Lighting and approved equal.

## 2.3 FIXTURE TYPES

A. Provide complete fixtures of the types scheduled on the Drawings and produced by a manufacturer with at least 5-years of successful experience in manufacturing fixtures of the type indicated.

1. Manufacturer's catalog numbers indicated are standard numbers only; for any modification and/or additional requirements, refer to Fixture Schedule and Drawings. Details shown on the Drawings are indicative of the general type desired and are not intended to restrict selection to fixtures of any particular manufacturer.

## 2.4 CLASSROOM CONTROLLER

A. Acceptable Manufacturer:

1. Cooper Controls

a. System: Room Controller QuickKit (RCQK)

2. Basis of design product: Cooper Controls Room Controller is subject to compliance and prior approval with specified requirements of this section, one of the following:

a. Cooper Controls Room Controller QuickKit (RCQK)

B. Wall Or Ceiling Mounted Occupancy Performance Requirements

1. Sensing mechanism:

a. Infrared: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

b. Ultrasonic:

1) Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.

2) Utilize Doppler shift ultrasonic detection technology.

2. Dual technology:



- a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
  - b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
  - c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.
3. Power failure memory:
    - a. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.
  4. Designed and tested to withstand discharges of 15,000 volts per IEC 801-2 without impairment of performance.
  5. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.
  6. Sensor shall have time delays from 10 to 30 min.
  7. When specified, sensors shall automatically adjust time delay and sensitivity settings.
  8. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
  9. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
  10. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

C. Ceiling Mounted Sensors

1. Product: [OAC-DT-2000], [OAC-DT-1000], [OAC-P-1500].
2. Provide all necessary mounting hardware and instructions.
3. Sensors shall be Class 2 devices.
4. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
  - a. OCC-RJ45 Room Controller accessory is used to allow any standard Occupancy/ Vacancy Sensor to utilize Click & Go cable connections.
  - b. Two RJ45 connection ports for connection to Room Controller.

- c. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.
5. Device calibration and features:
    - a. Sensitivity – 0-100% in 10% increments.
    - b. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
    - c. Test mode – Fifteen second time delay.
    - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
    - e. Walk-through mode.
    - f. Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.
    - g. Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area, shall not be acceptable.
    - h. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
    - i. All load parameters including Automatic On/Manual On, blink warning and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.
  6. Device Status LEDs including:
    - a. PIR Detection
    - b. Ultrasonic detection
  7. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.
  8. Manual override of controlled loads.
  9. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required
  10. Where specified, sensor packaging shall be 100% recycled [made entirely from post consumer waste (100% post consumer fiber content) as well as, 100% recyclable].
  11. Sensors shall be RoHS compliant.

D. Wall/Corner Mounted Sensors

1. Product: [OAWC-P-120W], [OAWC-P-009L-H], [OAWC-DT-120W],
2. Provide all necessary mounting hardware and instructions.
3. Sensors shall be Class 2 devices.
4. Connect to Room Controller via Click & Go cable to eliminate wiring errors.
  - a. OCC-RJ45 Room Controller accessory is used to allow any standard occupancy/ vacancy sensor to utilize Click & Go cable connections.
  - b. Two RJ45 connection ports for connection to Room Controller.
  - c. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.
5. Device calibration and features:
  - a. Sensitivity – 0-100% in 10% increments.
  - b. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.
  - c. Test Mode – Fifteen second time delay.
  - d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
  - e. Walk-Through Mode.
  - f. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
  - g. All load parameters including Automatic-On/Manual-ON, blink warning, and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.
6. Device Status LEDs including:
  - a. PIR Detection
  - b. Ultrasonic detection
7. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.
8. Manual override of controlled loads.
9. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

10. Where specified, sensor packaging shall be 100% recycled [made entirely from post consumer waste (100% post consumer fiber content) as well as, 100% recyclable].
11. Sensors shall be RoHS compliant.

E. Room Controller Digital Wallstations

1. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:
  - a. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
  - b. Intuitive button labeling to match application and load controls.
2. Two RJ-45 ports for connection to the Room Controller local network.
3. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.
4. Room Controller digital wallstations are delivered with pre-defined functions including, raise, lower, A/V mode, Quiet Time, manual and scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.
5. Optional custom labeling is available for application or location specific wall-station button labels.
6. Cooper Controls catalog numbers:

RC-2TLB-ES1-*	Entry, All Off (2 large buttons *= W,V,B,G)
RC-6TSB-TS1-*	General, Whiteboard, Quiet Time, A/V Mode, Raise, Lower (6 small buttons *= W,V,B,G)
RC-6TSB-TS2-*	General, Whiteboard, Quiet Time, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-5TSB-TS3-*	General, Whiteboard, Quiet Time, A/V Mode, All Off (5 small buttons *= W,V,B,G)
RC-6TSB-TS4-*	General, Whiteboard, A/V Mode, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-4TSB-TS5-*	Entry, General, Whiteboard, All Off (4 small buttons *= W,V,B,G)
RC-6TSB-TS6-*	Entry, General, Whiteboard, Raise, Lower, All Off (6 small buttons *= W,V,B,G)

RC-6TSB-TS7-*	Row 1, Row 2, Row 3, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-TS8-*	Uplights, Downlights, Accent, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-6TSB-CR1-*	General, Meeting, Whiteboard, Presentation, Raise, Lower (6 small buttons *= W,V,B,G)
RC-4TSB-HC1-*	General, Exam, Reading, All Off (4 small buttons *= W,V,B,G)
RC-6TSB-HC2-*	General, Exam, Reading, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-3TLB-OS1-*	Half Lights, Full Lights, All Off (3 large buttons *= W,V,B,G)
RC-5TSB-OS2-*	Half Lights, Full Lights, Raise, Lower, All Off (5 small buttons *= W,V,B,G)
RC-6TSB-OS3-*	Half Lights, Full Lights, Undercabinet, Raise, Lower, All Off (6 small buttons *= W,V,B,G)
RC-2TLB-OS4-*	All On, All Off (2 large buttons *= W,V,B,G)

F. Room Controller Slider Station

1. Low voltage slider station is available in white, ivory, grey and black; compatible with wall plates with decorator opening. Slider stations shall include the following features:
  - a. Automatic raise/lower control of dimming loads.
  - b. Intuitive user control of dimmable lighting.
2. One RJ-45 port for connection to the Room Controller local network.
3. Cooper Controls catalog numbers: [RC-SS1-W],[RC-SS1-G],[RC-SS1-B],[RC-SS1-V].

G. Handheld Remote Controls (Optional)

1. Battery-operated handheld 10 button configuration for remote daylight sensor configuration. Remote controls shall include the following features:
  - a. Two-way infrared (IR) transceiver for line of sight communication with the Room Controller daylight sensors within up to 30 feet.
  - b. Red communication LED on the daylight sensor confirms button press.
  - c. Inactivity timeout to save battery life.
2. Three intuitive daylight sensor range push buttons.
3. Intuitive daylight zone adjustment raise/lower pushbuttons.
4. Cooper Controls catalog numbers: [HHPRG-RC].

## H. Room Controllers

1. Room Controllers are fully functional out-of-the-box to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will include line voltage wiring space and will not require additional electrical junction boxes. The control units will include the following features:
2. Fully functional room configuration to the most energy-efficient sequence of operation based upon the connected devices in the room.
3. Simple replacement – Using the automatic configuration capabilities, a Room Controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
4. Quick installation features including:
  - a. Included line voltage space to simplify wiring and eliminate the need for separate junction boxes.
  - b. Included emergency voltage space to simplify wiring of emergency luminaire connections.
  - c. Breakouts for direct conduit connection.
  - d. Line and low voltage sections include conduit connection points. Systems that require special accessories for direct conduit connections may not comply with local building codes and shall not be acceptable.
  - e. Quick low voltage connections using standard RJ-45 QuickConnect cable.
  - f. Dual voltage (120/277 VAC, 60 Hz).
  - g. Zero cross circuitry for each load.
  - h. Three relay configuration.
  - i. Efficient 150 mA switching power supply.
  - j. Six RJ-45 Click & Go local network ports.
  - k. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.
5. On/Off/Dimming Room Controllers shall include:
  - a. Real time current metering (optional).
  - b. Three relay, two 0-10V dimming zone configuration [RC3D2].
  - c. Three relay, three 0-10V dimming zone configuration [RC3D].
  - d. Three relay, three 0-10V dimming zone configuration for class rooms [RC3DEHC].

- 1) All models support local network connections of wallstations, occupancy-based controls and receptacle controls.
  - 2) Up to three 0-10V analog outputs per relay for control of compatible ballasts and LED drivers.
6. Cooper Controls catalog numbers: [RC3],[RC3D2],[RC3D],[RC3DE],[RC3DEHC].

I. Daylight Photosensors

1. Daylight photo-sensors work with Room Controllers to provide automatic daylight dimming capabilities for any load type connected to a room controller. Open loop daylight sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Daylight sensors shall be interchangeable without the need for rewiring. Daylight sensors shall be capable of daisy chaining with occupancy sensors in each room.
2. Digital daylight sensors include the following features:
  - a. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve.
  - b. The daylight sensor has three light level ranges: Low (3-300 lux), High (30-3000 lux), Direct Sun (300-30000 lux).
  - c. For dimming daylight harvesting, the daylight sensor shall provide the capability of controlling multiple (up to three) daylight zones immediately upon connection without programming.
  - d. Optional digital wallstations to allow occupants to reduce lighting level to increase energy savings and lower lighting levels for a selected period of time or cycle of occupancy.
  - e. Infrared (IR) transceiver for daylight sensor range and daylight zone gain adjustments via handheld remote programmer.
  - f. Red configuration LED that blinks to indicate data transmission.
  - g. One RJ-45 port for connection to Room Controller local network.
  - h. An adjustable head and an optional mounting bracket to accommodate multiple mounting methods and building materials. The daylight sensor may be mounted on a ceiling tile, skylight well, suspended lighting fixture or backbox.
3. Open loop digital daylight sensor includes the following additional features:
  - a. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

- b. Automatically establishes dimming set-points upon power up without any programming. Optional calibration using the wireless IR handheld programmer.
- c. Cooper Controls Catalog Number: [DS-FMOIR].

J. Room Controller Local Network

- 1. The Room Controller local network is a physical connection and communication protocol designed to optimally control a space within a building. Room Controller devices connect to the local network using CAT 5e cables with RJ-45 QuickConnect cables which provide both data and power to room devices. Features of the Room Controller local network include:
  - a. Click & Go default functionality of occupancy sensors, wallstations, slider station, daylight sensors, receptacle controls, BMS status output and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
  - b. Replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

K. Emergency Lighting

- 1. Room Controller with emergency relay – The Room Controller is a UL 924 listed device that monitors normal power circuit to the Room Controller. The Room Controller has a dedicated UL 924 output which includes emergency power line in and emergency power load out connections. The UL 924 relay will track with output 1 (Yellow) during normal power operations. Upon loss of normal power the UL 924 output will force the emergency lighting On and full bright (if dimming) until normal power is restored. Features include:
  - a. 120/277VAC, 50/60 hz, 3 amp ballast rating.
  - b. Ladderless testing: Push the “All Off” button on any wall station four times [e-mer-gen-cy], will turn off normal lighting and force UL 924 emergency output On and full bright.
  - c. Auxiliary input for remote Alert Mode (All On, and full bright).
  - d. Cooper Catalog Number: RC3DE.
- 2. Cooper Emergency Power Control – A UL 924 listed device installs down line of an output that monitors a switched or dimmed circuit providing normal lighting to an area. The unit provides normal ON/OFF or 0-10V dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
  - a. 120/277 volts, 50/60 Hz., 20 amp ballast rating.



- b. Push to test button.
- c. Cooper Catalog Numbers: CEPC-1 (switching), CEPC-DF-S-120 or CEPC-DF-S-277 (dimming).

END OF SECTION 26 51 00

**SECTION 27 13 43  
COMMUNICATION SERVICES CABLING**

Part 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1. Examination of site prior to bidding: General Conditions, Section 00700, Article 2.1.1.

B. Related Work Described Elsewhere:

1. For detailed description of the electrical work see other related sections in Division 26.

1.2 DESCRIPTION

A. This document is not a stand-alone specification. Contractor's bid shall be based on the design requirements stated, and the detailed drawings and specifications for the project.

B. The installing Contractor shall provide all equipment, labor, materials, and services required to install the complete Backbone and Horizontal cabling system. The installation is to be accomplished in accordance with these specifications and accompanying plans.

C. Section includes:

1. Blueprint symbol list for telecommunication cable outlets.
2. Outlets and cabling for workstations, wireless units, building control units and audio-visual equipment
3. Main Distribution Frame (MDF), Intermediate Distribution Frames (IDF's), Telephone Terminal and miscellaneous Data and Voice cabling/termination requirements
4. Horizontal wire and cable distribution.
5. Horizontal tie cables.
6. Multi-pair copper and fiber optic cable requirements.
7. Copper and fiber optic terminations.
8. Telephone closet terminations.

9. Miscellaneous hardware and equipment.
10. Acceptance testing.
11. Documentation and labeling.
12. Phasing of Construction.

### 1.3 DEFINITIONS

- A. MDF – A Main Distribution Frame (MDF) is a room containing a freestanding or wall-mounted rack that serves as the termination point for connectors coming from the IDF locations on other floors within the same building and the connection point for connecting the building to the Campus MDF.
- B. Campus MDF – A building and room specified by the owner where the fiber optic cable and multi-pair voice cable coming from the building MDF are terminated.
- C. IDF – An Intermediate Distribution Frame (IDF) is a room containing a freestanding or wall-mounted rack for managing and interconnecting the telecommunications cable between end user devices and a main distribution frame (MDF). For example, an IDF might be located on each floor of a multi-floor building routing the cabling down the walls to an MDF on the main floor. The MDF would contain cabling that would interconnect to the other buildings.
- D. Main Telephone Terminal (or Backboard) – is a location that includes the main terminations of the telephone utility service entrance cable, the telephone system control equipment, head-end termination of the telephone station wiring and other miscellaneous equipment that may connect to the telephone service (directly or through the systems control equipment).
- E. AFF – Above Finished Floor indicates the distance from the final floor material that an outlet should be located.
- F. LIU – Light Interface Unit

### 1.4 REFERENCES AND STANDARDS

- A. All equipment shall conform to appropriate U.L. listings. All work shall conform to the latest revisions of the following codes and standards, where applicable; when a conflict occurs, follow the most stringent requirements:
  1. California Building Code (CBC)
  2. California Electric Code (CEC)

3. National Fire Protection Association (NFPA) Standards including:
  - a. NFPA-70 National Electric Code (NEC) - 2014
4. California State Fire Marshal (CSFM).
5. Underwriters' Laboratories (UL)
6. American National Standards Institute (ANSI)
7. Institute of Electrical and Electronics Engineers (IEEE)
8. National Electric Manufacturer's Association (NEMA)
9. USA Standard Code for Information Exchange (ASCII)
10. Electronics Industries Association (EIA/TIA) including:
  - a. TIA/EIA-568-B : Commercial Building Telecommunications Cabling Standard
  - b. TIA/EIA-569-A : Commercial Building Standard for Telecom Pathways and Spaces
  - c. TIA/EIA-606: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  - d. J-STD-607: Commercial Building Grounding/Bonding
  - e. TIA/EIA-758-A: Customer-Owned Outside Plant Telecommunications Cabling Standard.
11. City, State and other local codes and requirements as applicable.

#### 1.5 SUBMITTALS/QUALITY ASSURANCE

A. Refer to Section 01330 (Shop Drawings, Product Data and Samples) for detailed procedures on submittals.

1. The Contractor shall provide full documentation of the equipment and planned installation.
2. All work shall be in accordance with "General Conditions", scope of work documents, campus standards, and specific manufacturer's recommendations.
3. Identify deviations from requirements of contract document, in writing, at time of submission.
4. Do not commence work until Engineer returns submittals with properly executed stamp indicating review and approval.
5. The submittals shall include:

- a. A copy of the authorized distributor's valid C-7 or C-10 California State Contractors License.
- b. Letters of factory authorization or certification from the manufacturer to install the equipment offered.
- c. A list of 5 successfully completed projects of similar or equal scope.

6. The submission shall consist of the following:

- a. The project title and address, name of the firm submitting the proposal and name of the consultant. Each page in the submission shall be numbered chronologically and shall be summarized in the index.
- b. A complete list of materials with model and part numbers and reference to the specification paragraph number.
- c. A complete set of detailed manufacturer's specifications describing and illustrating all standard and special components and materials.
- d. A complete set of drawings for special items.
- e. A single line block diagram showing exactly the manner in which the Contractor proposes to engineer the system.
- f. Illustrations and scale drawings of racks and cabinets. Drawings shall include designations, dimensions, operating controls, instruments, etc.
- g. A list of proposed instrumentation to be used by the Contractor for testing with current calibration certifications per manufacturer's recommendations.

7. Prior to acceptance testing, the Contractor shall submit the following for review:

- a. Three copies of redline markups are to be provided on clean blueline prints of drawings and on 8-1/2" x 11" paper.
- b. "Cable run lists" in a format that clearly identifies and labels each cable run, the terminating locations, the type of cable, and the type and number of conductors in each cable in the run. This is to be submitted for approval prior to transfer to drawings.
- c. All diagrams and/or drawings shall be provided on CD in AutoCAD and pdf file formats.

## 1.6 CONTRACTOR QUALIFICATIONS

A. The installing Contractor shall hold valid California State C-7 or C-10 License and shall:

1. Have successfully completed at least 5 projects of equal scope. The projects shall have included:
  - a. The installation, termination, documentation and full acceptance testing of air blown fiber optic backbone systems.
  - b. The installation, termination, documentation and full acceptance testing of Category "6" unshielded twisted pair (UTP) from termination backboards to workstation outlets utilizing Systimax-type 110 or RJ45 termination devices.
  - c. The installation and termination of multi-pair copper cabling to support voice applications.
  - d. Full documentation, labeling, and acceptance testing of all installations.
2. Have been in the business of furnishing and installing communication systems of this type for at least ten (10) years.
3. The Contractor shall have at least five (5) years of experience as an installer with the submitted manufacturer.
4. Furnish references from at least five (5) projects of equal scope using the submitted manufacturer's products.
5. The Contractor shall maintain, and have available for inspection, certification from Sumitomo ensuring the qualifications of the Contractor's installation team for Air Blown Fiber.

## 1.7 CONTRACTOR RESPONSIBILITIES

A. The following is a brief description of Contractor responsibilities. The installing Contractor shall:

1. Provide equipment and labor to render the cabling system complete and operable for all outlet locations, as specified and as indicated on the Drawings.
2. Provide horizontal distribution systems as specified and as indicated on the Drawings.
3. Conform to serving utility company standards, equipment manufacturer's standards, and any provided Owner's standards, where applicable.
4. Provide hardware and cable dressing to be consistent with layout and appearance of other installed systems as directed by the owner and as specified. Velcro Straps Not Tie-Wraps.

5. Coordinate installation with Construction Schedules generated by the General Contractor. All scheduling shall be coordinated with the General Contractor.
6. Coordinate with other trades, ensuring that installed raceways, cable and equipment are not damaged by other construction activity.
7. Coordinate installation requirements with electrical drawings and specifications.
8. The Owner reserves the right to issue other contracts in connection with the installation of the system, and the Contractor shall afford any such other Contractors reasonable opportunity for the installation and execution of their work, shall properly connect and coordinate its work with theirs as required.

## 1.8 INSTALLATION REQUIREMENTS

- A. The installation is to be accomplished in accordance with these specifications and accompanying drawings and/or mark up by Owner.
- B. The systems shall provide full connectivity from each voice and each data workstation outlet location to the respective MDF, IDF or telephone terminal.
  1. All data/voice cabling shall be ran and terminated to the new IDF/MDF unless approved by owner.
- C. The fiber optic cabling system shall be installed to provide full connectivity from the IDF on each floor of a multi-story building to the MDF of the same building and from the building MDF to the Campus MDF as identified by the Owner. All fiber optic cable shall be terminated and tested at each location.

## 1.9 ENGINEERING CONSIDERATIONS

- A. All inter-building cabling (copper, multi-pair, fiber optic) shall be plenum-rated.
- B. The cabling routing to all work locations will be in combination of conduit, free air, conduit chases and raceways. Workstation locations are to be served from individual outlet boxes and/or from multi-channel surface raceway as indicated on the plans. The Contractor will verify adequacy of cable routing systems being installed and notify the Owner of any potential conflicts for resolution prior to construction.
  - a. Cable bundles shall be supported via "J" hooks attached to the existing building structure and framework at a maximum of five (5) foot intervals. Wide reinterable hangers are recommended.
  - b. Cable bundles shall not exceed 1" in diameter, with no more than (3) bundles per hanger support.
  - c. Plenum rated cable ties shall be used in all appropriate areas.
  - d. Velcro ties shall be used. In all areas where Plenum cables ties are not required.

- e. The Contractor shall adhere to the manufacturers' requirements for bending radius and pulling tension of all data and voice cables.
  - f. Cables shall not be attached to lift out ceiling grids supports or laid directly on the ceiling grid.
  - g. Cables shall not be attached to or supported by fire sprinkler heads or delivery systems or any environmental sensor located in the ceiling air space.
- C. Cabling between all outlet locations shall be made as individual home runs to the IDF/MDF located on each floor. Maximum horizontal cable length not to exceed 280'.
- D. Station wiring shall not be installed near fluorescent lamps, high-voltage sources, electrical motors, or other source of interference.
- 1. To avoid electromagnetic interference, all distribution should provide clearance of at least:
    - a. Four (4) ft. from large motors and/or transformers.
    - b. One (1) ft. from conduit and cables used for electrical distribution.
    - c. Five (5) in. from fluorescent lighting. This 5" distance is in reference to modular furniture cable channels. It is recommended that horizontal UTP cables be placed at a minimum distance of 24" from fluorescent fixtures.
    - d. Refer to TIA/EIA 568B, 569 and ANSI/NFPA 70 for additional cable clearance.
- E. All rooms within the building except for offices, study rooms and storage rooms shall include a single Systimax M10LW-262 voice outlet mounted at 48" AFF for the installation of a wall phone. Contractor to ensure that the outlet location has sufficient clearance to mount a standard District wall phone.
- F. All classroom, labs and meeting rooms that call for a ceiling mounted projection system shall include a dual data outlet located in the ceiling adjacent to the power receptacle for the projector. If provided, the data outlet shall be mounted in the projector plate. Otherwise, the cable shall be terminated in the ceiling in a single-gang box and labeled.
- G. All single data outlets specified for wall-mounted wireless units shall be mounted at eight (8') foot AFF but must be 6" below finished ceiling. The outlet locations shall be free from obstruction. Any issues about the outlet placement should be discussed with the owner prior to proceeding.
- H. Quantity and size of conduits to the building, sleeves between the floors, wiremold and termination locations shall be verified with the Owner before commencing work. Conduit quantity and size shall meet or exceed all specifications for inter-building cabling.
- I. Pull strings shall be provided in all conduits. Strings shall be labeled on both ends with their final location.



- J. The maximum length of any cable run shall not exceed 89 meters (295 feet) without approval of the Owner.
- K. Unless specifically noted, all workstation and audio-visual data locations shall be installed within six (6) inches of a standard electrical outlet. The Contractor shall verify electrical outlet proximity and notify owner of any discrepancy prior to installation.

## 1.10 DESIGN CRITERIA

### A. Sleeves and Conduit to Horizontal Cabling

1. To facilitate cable pulling, sleeves and slots should be located adjacent to the door. Sleeves or slots shall not be left open except during cable installation and shall be properly firestopped per applicable codes.
2. The number and size of sleeves, slots or conduits shall be determined in ANSI/TIA/EIA-569-A, but no less than 2-4" conduits for backbone wiring. For horizontal pathways not less than three (3) 4" sleeves per floor. Sleeves of adequate size shall also be provided for the vertical backbone cabling between telecommunications closets.
3. Where a closet serves more than one floor a minimum of three (3) 4" conduits shall be routed from the telecommunication closet to the pathway of the horizontal cabling on that floor which typically is the hung ceiling. **NOTE:** Size sleeves through floors and wall to accommodate conduit size.
4. Conduits protruding through the floor in the telecommunications closet shall be terminated 3 in. above the floor surface with a bushing. (Subject to Acls/OCS approval).
5. All sleeves and conduits must have bushing installed on both ends. No unfinished end shall be permitted.
6. All sleeves and conduits shall be EMT; flex conduit shall not be permitted without prior owner approval.

### B. Environmental Considerations

1. In all new building construction, a dedicated mechanical means (capable of operating 24/7 without dependence on other systems) of cooling shall be provided to each data room to maintain 75-degree F with an approximate 12,000 BTUH heat load. The equipment can be unitary to each closet on centralized servicing all data rooms in the building.

### C. Fire Stopping

- a. Sealing of openings between floors, through rated fire and smoke walls, existing or created by the contractor for cable pass through shall be the responsibility of the Contractor.

- b. Sealing material and application of this material shall be accomplished in such a manner, which is acceptable to the local fire and building authorities having jurisdiction over the work.
  - c. Creation of such openings as are necessary for cable passage between locations as shown on the drawings shall be the responsibility of the Contractor.
  - d. Any opening created by or for the contractor and left unused shall also be sealed as part of this work.
- D. Data System MDF / IDF Terminations: Data workstation wiring (See PART 2 – PRODUCTS) shall be terminated at the MDF and/or IDF per the Drawings. MDF/IDF backboard terminations for data cabling shall be terminated on appropriate number of Systimax 110 IDC equipped, RJ45, Category 6 compliant patch panels.
- 1. The termination blocks, data equipment racks and data cabinets shall be installed on 3/4" AC fire treated, Class 1, UL stamped plywood backboard. Contractor shall furnish and install plywood backboards at locations noted and/or required. Plywood shall be mounted twelve (12") inches AFF.
  - 2. Systimax 110 equipped, RJ45, Category 6 compliant patch panels shall be mounted on 19" racks and/or cabinets, as specified in this section.
  - 3. Cabling shall be installed consisting of one Category 6 UTP cable (see PART 2 – PRODUCTS) wired from the MDF or IDF to each designated data outlet. The cable shall be installed, terminated, and tested at each end by the Contractor.
  - 4. Discrete and individually designated IDF/MDF Systimax 110-equipped, RJ45, termination block and patch panel backboard fields shall be installed for all appropriate data outlet cables, and data system port fields.
  - 5. Data wiring and cabling – Appropriate manufacturer-approved Category 6 patch panels and breakout kits shall be provided as required.
  - 6. Provide one (1) empty 48-port Category 6 patch panel in each IDF/MDF mounted as the last panel in the rack for future terminations.
- E. Voice (Telephone) System Terminal (Backboard) Terminations: Voice workstation wiring (See Part 2 – PRODUCTS) and inter-building multi-pair copper cabling shall be terminated at the Telephone Terminals per the Drawings. Telephone backboard terminations for voice cabling shall be terminated on appropriate number of termination blocks.
- 1. The termination blocks, voice equipment racks and related items shall be installed on 3/4" AC fire treated, Class 1, UL stamped plywood backboard. Contractor shall furnish and install plywood backboards at locations noted and/or required.

2. Cabling shall be installed consisting of an UTP cable (see PART 2 – PRODUCTS) wired from the Telephone Terminal to each designated voice outlet. The cable shall be installed, terminated, and tested at each end by the Contractor.
  3. Discrete and individually designated Siemon #566M1-50 termination blocks and backboards fields shall be installed for all appropriate voice outlet cables.
  4. All voice terminations shall be cross-connected per the 568B Telecommunications Standards. All voice terminations shall be on Siemon Co. #566M1-50 terminal blocks.
- F. Backbone Voice Multi-Pair Copper: Cabling shall be installed, fully terminated, and provide full connectivity from the Main Telephone Terminal in the Campus MDF to all “sub” terminals, and shall be terminated at both ends on Siemon #566M1-50 termination blocks. Provide sufficient termination blocks to terminate at least 1.25 pairs per voice outlet, (for example: if there are 158 voice outlets in the schedule,  $158 \times 1.25 = 197.5$  – two 100-pair cables or one 200-pair cable will be required.) (Any building to building copper backbone cabling must be OSP rated and terminated on each end on the appropriate Building Entrance Protectors with associated modules)
- G. Voice and Data Stations: Each UTP cable (Section 2 – PRODUCTS) will terminate on Systimax 110-equipped, RJ-11 and RJ-45 outlets respectively at work locations.
1. Voice and Data Outlet Locations: Voice and Data outlets shall be located as indicated on the Drawings.
  2. Data and Voice Outlet Wiring: The Owner has implemented a standard wiring configuration for all locations that includes the following:
    - a. All data outlets shall be color coded with orange RJ-45 outlets.
    - b. All voice outlets shall be color coded with white RJ-11 outlets.
    - c. Dual Voice/Data RJ-45 outlets consisting of 1 voice cable split (Splitting of pairs behind the outlet is not permitted by TIA/EIA 568-B Standard) and 2 data outlets, shall be located in a single wall box location, for each workstation or equivalent; or in multi-channel surface raceway as indicated on the Drawings.
    - d. Single data or voice RJ-11 or RJ-45 outlet, consisting of 1 voice cable or 1 data outlet, shall be located in a single wall box location with one outlet active and blanks as required, for each workstation or equivalent; or in multi-channel surface raceway as indicated on the Drawings.
    - e. Each data outlet is to be wired from the IDF/MDF as indicated with individual 4-pair Unshielded Twisted Pair (UTP) Category 6 cable with Systimax Category 6 RJ-45 jacks. The outlet shall be completely wired back to the IDF/MDF and terminated on Systimax 110-equipped, RJ-45 patch panels.

- f. Each voice outlet shall be wired from the telephone terminal as indicated with individual 4-pair UTP Category 6 cable. The RJ-11 jack shall be completely wired back to the telephone terminal and terminated on Siemon Co. #566M1-50 terminal blocks.
  - g. Each combination voice/data outlet is to be wired with 2 individual 4-pair UTP Category 6 cables for data and 1 individual 4-pair UTP Category 6 cable split (Splitting of pairs behind the outlet is not permitted by TIA/EIA 568-B Standard) for voice, each is to be terminated as described above.
  - h. The 568B Wiring Standard Method shall be adhered to for all outlets unless otherwise directed.
  - i. Where voice and/or data outlets are installed in multi-channel surface raceway, install wiremold devices that accept Systimax faceplates and data outlets, and all necessary components required for a complete installation.
- H. Fiber Optic Cabling: An air-blown fiber optic cabling backbone shall be installed that connects the building MDF to all IDF locations as well as the Owner identified Campus MDF. The new backbone shall provide full connectivity to all connected locations.
- a. Connectivity between IDF and MDF shall consist of six (6) strand single-mode air blown fiber.
  - b. Connectivity between Building MDF and Campus MDF shall consist of twelve (12) strand single-mode fiber.

## 1.11 DOCUMENTATION AND LABELING

- A. The Contractor shall provide printed labels for all cables and cords, distribution frames and outlet locations. No labels are to be written by hand.
1. An example of appropriate outlet documentation/labeling shall be as follows:
 

Outlet label on faceplate or wiremold = D2-26

Type outlet:

    - D      D = Data only  
          V = Voice only
    - 2      patch panel number
    - 26     patch panel port
  2. An example of appropriate patch panel documentation/labeling shall be as follows:
    - 48 port patch panels shall be sequentially numbered starting with the top patch panel (or top left patch panel in a multiple rack design) and continuing through all patch panels in the rack.

- The pre-printed port numbers on the patch panels will serve as the port number on the panel for this labeling system.
  - For example, for the purpose of this labeling system, the 1<sup>st</sup> port on the second 48-port patch panel in the rack would be identified as D2-1.
3. An example of appropriate inter-building cabling documentation/labeling at MDF and IDF locations for fiber optic cabling shall be as follows:
- Label on LIU (Light Interface Unit) = 12 Strand Single-Mode from Bldg "A" Room 101.
- 12 Strand (The number of strands provided)
  - Single-Mode (the type of Fiber used in the installation)
  - Bldg "A" (The name of the building the fiber is coming from)
  - Room 101 (The room number where the fiber is terminated in the bldg)
4. Labeling system shall be verified with the Owner for accuracy before starting work.

#### 1.12 PHASING OF WORK

- A. The project will be constructed in multiple phases as described elsewhere in the Contract Documents.
- B. Contractor shall include all phasing costs in his/her bid.
- C. Contractor shall furnish and install all temporary and/or interim connections as indicated and/or required for proper operation of all systems during all phases of construction.
- D. Refer to Drawings for additional phasing information and requirements.

#### 1.13 SUBSTITUTIONS

- A. General: Only written approval of the Architect in consultation with the District Information Technology and Telecommunication staff will permit substitutions for materials specified: See section 00700, General Conditions for procedure.
- B. Equivalent products may be considered for substitution for those products specified, however, any equivalent cabling product(s) must show demonstrated and documented equivalence to the product(s) specified.
  - a. Documentation shall include, but is not limited to: product samples, data sheets and actual test data.
  - b. The request for product substitution, and supporting documentation, must be submitted, in writing, prior to submitting the bid.
  - c. Written approval from the Owner for product substitution must be submitted with the bid.

#### 1.14 QUALITY ASSURANCE

A. General: As specified in Section 26 05 00.

#### 1.15 SUBMITTALS

A. General: Comply with the provisions of Section 01300 and as specified in Section 26 05 00.

#### 1.16 PRODUCT HANDLING

A. General: As specified in Section 26 05 00.

### **PART 2 – PRODUCTS**

#### 2.1 WIRE AND CABLE

A. The following are acceptable products that have been identified for use on District projects. Deviation from this list is prohibited without written permission of the District Information Technology and telecommunication staff.

1. Voice and Data Workstation Cabling: Category 6, active 4-pair, 24 AWG, UTP workstation cabling as defined in EIA/TIA TSB-67 and 568.B.2-1 for Category 6 cable.
  - a. Acceptable products shall include Systemax 1071E/2071E or approved and certified Category 6 products.
  - b. The Category 6 cables for data and voice outlets shall be color coded (refer to PART 1 – GENERAL) as follows:
    - 1) Category 6 cable for Data outlets      White outer jacket
    - 2) Category 6 cable for Voice outlets      White outer jacket
2. Fiber Optic Cabling: Single-mode air blown fibers, ISO (International Standards Organization) and FDDI (Fiber Distributed Data Interface) standard, fiber optic cable shall be installed as described.
  - a. Inter-building cabling shall be Futureflex duct-rated cabling for exterior installation. The number of fibers installed shall be per documentation.
  - b. Connectors shall be Unicam LC type ceramic of appropriate manufacture. All single-mode fibers shall be connectorized.

- c. FutureFlex tube distribution cabinets shall be used at each MDF and IDF where air blown fiber is terminated. Tube cells will maintain a standard service loop inside the cabinet for servicing the ABF system.
- d. The standard number of tube cells shall be used based on the number of fiber strands installed.
- e. Fiber shall be terminated at both ends in Siecor rack mounted fiber enclosure (NIC) utilizing six-pack duplex LC connector part #CCH-CP06-59.
- f. All unused tube cells must be capped at both ends with approved sumitomo product.

3. Inter-Building Multi-Pair Copper Cabling:

- a. Inter-building multi-pair copper cabling shall be duct-rated, black cable – typically 50 or 100 pair, as indicated on the Drawings.
- b. Cabling shall be terminated at both ends on appropriate Siemon Co. # 566M1-50 terminal blocks. (Any building to building copper backbone cabling must be OSP rated and terminated on each end on the appropriate Building Entrance Protectors with associated modules)

B. Acceptable cable products, by category, are as follows:

- |  |                     |
|--|---------------------|
| 1. Category 6 UTP                                  | Systemax            |
| 2. Single mode air blown fiber (indoor/outdoor)    | Futureflex # FB06SX |
| 3. Duct-rated multi-pair copper (inter-building):  | Superior Essex      |
| 4. Multi-pair copper (intra-building Riser-Rated): | Superior Essex      |

2.2 VOICE AND DATA OUTLETS

A. Voice/Data Workstation Terminations

- 1. Each Voice/Data cable shall terminate on individual Systemax 110-equipped, 568B terminated, RJ-11/RJ-45 outlets equipped with appropriate designations (D for data, V for voice) as specified in Section 1.11 and as shown in the drawings.

<u>OUTLET</u>	<u>COLOR</u>	<u>SINGLE PORT</u> <u>PART NUMBER</u>
Data	Orange	MGS400BH-112

Voice

White

MGS400BH-262

B. Mounting on Wiremold Multi-Channel Surface Raceway

1. Where noted or indicated on the Drawings, each RJ-11/RJ-45 outlet shall be mounted on the multi-channel surface raceway. Furnish and install a Wiremold device bracket (#5507 or #5507A4) at each location for mounting the voice and data outlets. The device brackets shall be shared with a duplex power receptacle(s) (if so indicated) at each location on the multi-channel raceway.
2. Where multiple outlets are indicated or where combination outlets are indicated, up to 6 voice/data outlets may be mounted in a single device bracket.
3. Device brackets and raceway shall be ivory in color as specified in Section 16110. RJ-45 outlets shall be orange and RJ-11 outlets shall be white as specified in this Section.

C. Mounting at Individual Outlet Box Location

1. Where noted or indicated on the Drawings, each RJ-11/RJ-45 outlet shall be mounted on a flush or surface mounted outlet box (as noted) with a single gang plaster ring (flush outlets) and a single gang modular faceplate. Where multiple outlets are indicated, up to 6 voice/data outlets may be mounted in a single faceplate.
2. Modular faceplate shall be Systemax and White in color. RJ-45 outlets shall be orange and RJ-11 outlets shall be white as specified in this Section.

D. Furnish and install all Systemax components and devices required for a complete installation, including but not limited to:

1. Molded plastic "Icon Buttons" to indicate telephone (voice) or data service to each Systemax RJ-11 or RJ-45 jack inserts.
2. Blank inserts as required to fill device brackets and faceplates. Blank inserts shall be white in color to match the device brackets and faceplates. Blank inserts shall be 1A, 2A, or 3A size as required to fill remaining space in device brackets or faceplate after required quantity of RJ-11/RJ-45 jacks are installed.

E. Utilize "single port" jacks at all locations except where multiple data or multiple voice jacks as indicated in a single location. The color coding of devices must be maintained – white for voice and orange jacks for data.

2.3 MDF/IDF TERMINATIONS:

A. Appropriate manufacturer-approved patch panels and breakout kits shall be provided as follows:



1. Light Interface Unit (LIU) for inter-building fiber optic backbone.
  - a. In MDF locations, Corning Cabling Systems Rack Mount Fiber Enclosure CCH-04U (Verify connector pack type with owner), with required brackets, shelves, panels, and related 19" rack mount hardware, shall be installed to terminate fiber optic cabling as per construction documents. Breakout kits to be furnished and installed by Contractor.
  - b. In IDF locations, Corning Cabling Systems Rack Mount Fiber Enclosure CCH-01U with required brackets, shelves, panels, and related 19" rack mount hardware, shall be installed to terminate fiber optic cabling as per construction documents. Breakout kits to be furnished, and installed by Contractor.
  - c. Contractor shall furnish and install all necessary LIUs and all related hardware, equipment, breakout kits, etc. as required to connect the fiber optic backbone.
2. Data workstation cables shall terminate on 568B, Systimax 110-equipped Gigaspeed XL Patchmax RJ-45 patch panels as follows:

<u>NUMBER OF PORTS</u>	<u>SYSTIMAX PART NUMBER</u>
<ul style="list-style-type: none"> <li>• 24 outlets</li> <li>• 48 outlets</li> </ul>	GS3-24 GS3-48

- a. Furnish and install all Systemax components and devices required for a complete installation including but not limited to: metal support brackets, white strain relief modules, etc.

## 2.4 TELEPHONE BACKBOARD TERMINATIONS.

- A. Voice workstation and multi-pair copper cable shall terminate on Siemon Co.# 566M1-50 Terminal Blocks as specified in PART 1 – GENERAL.

## 2.5 EQUIPMENT CABINETS AND RACKS

### A. TELECOMMUNICATIONS ENCLOSURE/RACKS

1. Each rack shall house equipment and devices of the following in various quantities:
  - a. Fiber optic termination hardware.
  - b. Fiber optic management panels.
  - c. Electronic equipment provided by others (coordinate with Owner).
  - d. Communications patch panels (voice and data).

- e. Horizontal and vertical cable management panels.
- 2. Provide and install quantity of racks to house the aforementioned equipment and devices plus 20 percent additional space for field changes and future expansion.
- 3. All racks shall be secured to the floor using the factory recommended hardware and installation practices.
- 4. All racks shall be properly grounded, conforming to J-STD-607-A, National Electric Code and all related grounding standards and codes.
- 5. All racks and enclosures will be grounded directly to a TGB and not to overhead tray or ladder racks.
- 6. Install cable racks in accordance with ANSI/NFPA 70, Article 318 requirements and as specified herein.
- 7. Whenever possible, provide a 3-foot clearance on three sides of each equipment rack.
- 8. All conduits shall enter the equipment rack from the rear top and/or rear bottom only.

**B. MDF/IDF – OPEN EQUIPMENT RACK**

- 1. Provide equipment racks as follows:
  - a. Overall approximate dimensions of 74” high x 19” rack mount wide x minimum 24” deep floor or wall mounted equipment rack.
  - b. MDF – Open Equipment Rack shall be Chatsworth Products, Inc., at least 24” deep, or approved equal.
    - A. Use CPI55053-703 or approved equivalent
  - c. Provide both horizontal and vertical cable management. Vertical cable management shall be Chatsworth Products, Inc., CCS combination cabling section (Part#30162-703) or approved equal.

**C. IDF EQUIPMENT CABINET/RACKS (IF NEEDED)**

- 1. The following IDF equipment cabinet enclosures shall be required if there is insufficient space to install an open equipment rack as determined by owner in consultation with the architect and contractor.
  - a. Lockable and secure with 2 keys provided by Contractor. (Keyed per Owner’s requirements.)

- b. Minimum 48" high x minimum 21" wide x minimum 24 deep.
- c. Double hinged cabinet with Plexiglas front door, rear wall mounted section.
- d. Swing out cabinet section shall be provided with adjustable front to back rails for mounting of standard 19" rack mounted equipment.
- e. Note that cabinets are double-hinged, requiring side clearance on the hinged side to allow access to all internal areas of the equipment cabinet. The wall area to the left or right (on left-hinged and right-hinged cabinets respectively) shall be clear to allow the cabinet door to swing out a minimum of 90 degrees from the wall. Coordinate hinge side and required clearances.
- f. Provide multiple equipment racks if/as required to house/mount all required equipment.
- g. Acceptable product is Hubbell Part Number MCC48WMC19 or approved equal.

## PART 3 EXECUTION

### 3.1 GENERAL

- A. It is not practical to enumerate in these specifications all details of fittings and accessory equipment required for proper operation of the system herein described. All fittings and accessory equipment required shall be supplied by the Contractor in accordance with manufacturers' installation standards without extra compensation.
  - 1. Splicing in not permitted. Each run of cable between the MDF, IDF, telephone terminal and termination block and the data outlets shall be continuous without any joints or splices.
  - 2. The Contractor shall provide hardware and cable dressing to be consistent with layout and appearance to acceptable communications industry standards for a "neat" installation.
  - 3. Provide pull lines in all installed cable pathways including conduit/raceway paths and accessible ceiling space cable installations, to expedite future installations. The pull lines shall be labeled at both termination locations and secured to prevent accidental removal.
  - 4. Pull lines shall be as specified in Division 16.
  - 5. All conduits shall have appropriate firestops installed in accordance with fire code.
  - 6. Each and every voice and data cable (Category 6 cable) terminated at the MDF, IDF or telephone terminal shall be installed with a minimum of 8' 0" of slack cable to allow future re-termination of each cable. The slack cable shall be routed and managed in a manner

acceptable to the Owner. This is a District standard requirement. It is designed to allow future use of a data cable as a telephone cable and vice-versa.

### 3.2 EQUIPMENT – GENERAL REQUIREMENTS

- A. All components must have been commercially available for at least one year prior to bid. In all cases, any proposed deviations from these specifications shall be approved in writing by the Owner.

### 3.3 SYSTEM PARAMETERS

- A. All cable routes differing from those described herein must be reviewed and approved by the Owner prior to construction.
- B. UTP runs shall not exceed 89 meters in length. Should existing conditions exceed this distance, Contractor shall notify Owner's representative prior to installation.
- C. Contractor to coordinate locations of all components with other trades and electrical systems prior to installation to avoid conflicts.
- D. Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP/fiber optic cable during handling and installation.

### 3.4 TERMINATIONS

- A. The Contractor shall provide any necessary screws, anchors, clamps, velcro straps, distribution rings, raceways (MDF, IDF and telephone terminal locations), miscellaneous grounding and support hardware, etc., necessary to facilitate the installation of the system.
- B. It shall be the responsibility of the Contractor to furnish any special installation equipment or tools necessary to properly complete the system. This may include, but is not limited to, tools for terminating cables, testing and splicing equipment for fiber cables, communication devices, jack stands for cable reels, or cable winches.

### 3.5 TESTING AND ADJUSTMENTS

- A. Preliminary Testing. The Contractor shall be responsible for the successful testing of ALL voice/data terminations and copper and fiber optic cable to established performance specifications for that cable type prior to acceptance of the distribution system.
- B. Prior to the acceptance tests, an acceptance test plan is to be provided to the Owner for their approval. Required documents for acceptance testing shall also include:
  - 1. MDF, IDF and Telephone Terminal Diagrams – Includes cable routing, position of all components and apparatus, detailed layout of the wallfield and labeling plan.

2. Work Area Floor Plans – Includes detailed cable routes and approved labeling plan for all work areas, information outlets and building control devices.
  3. Riser Distribution Plan.
  4. Cable Tray, Conduit and Raceway Plans.
  5. Campus Distribution Plan.
- C. In addition, Owner shall be advised prior to Contractor starting tests, so that Owner's representative may witness said tests.
- D. The installing Contractor shall provide termination-to-termination testing. All installed cabling (100%) shall be tested (TSB 67 performance standards or better).
- E. All testing is to be documented and results shall be provided to the Owner in hard copy and on a CD in Excel format.
- F. Acceptance Testing. At the Owner's direction, the Contractor shall perform initial acceptance testing consisting of a random sample of 10% of each installed distribution system. The Contractor shall be responsible for providing proper test equipment and staff to conduct the tests. An Owner's representative shall witness all tests.
- G. Should the initial 10% test not be 100% successful, the Contractor shall repair/replace faulty components (at the discretion of the Owner), and shall re-verify and re-submit 100% test results of all cabling. A 20% random sample shall then be conducted to ensure proper performance of the system. Should there be a failure in this retest, the Contractor shall repeat the retest procedure until such time as all cabling is verified, successfully tested, and accepted.

### 3.6 ACCEPTANCE TESTING OF COMPLETED INSTALLATION

- A. Testing Fiber optic cable – Fiber optic cable shall be tested in accordance with standards for Single-Mode Air Blown Fiber as specified in EIA/TIA section 455.
1. The optical power loss test shall be tested for correctness of termination and overall transmission loss using an approved Optical Loss Test Set for singlemode fibers of each installed fiber link segment.
  2. Each strand in fiber optics cables shall be tested for correctness of termination and overall transmission loss using an approved Optical Loss Test Set for singlemode fibers of each installed fiber link segment.

3. An optical fiber link segment is defined as the passive cabling network, to include cable, connectors, and splices (if present), between two optical fiber patch panels (connecting hardware).
  4. Attenuation, defined as optical power loss measured in decibels (dB) shall measure the total system attenuation of each fiber link.
  5. Measure the attenuation of each link end to end after installation.
  6. Any fiber optic pairs not meeting minimal standards shall be repaired or replaced by the Contractor (at the option of the Owner).
- B. Documentation:
1. A report shall be provided listing the test results, including both the calculated and measured loss for each fiber.
  2. All terminated fiber pairs shall be tested. The attenuation of the fiber optic system shall be measured and documented in at least one direction and at both wavelengths.
  3. Results of the testing and procedure shall be provided to the Owner. (One hard copy and in "Excel" format on CD.)
- C. Twisted Pair – Acceptance test for Category 6 twisted pair shall include TSB 67 criteria and include the following:
1. All cabling – Continuity, wire map, open, breaks, shorts, and grounds.
  2. UTP cabling – In addition to the above tests, attenuation, near-end cross-talk, impedance, capacitance, and resistance, and the like.
  3. Any test not meeting EIA Category 6 performance specifications shall be reported to the Owner as trouble and shall be repaired or replaced by the Contractor (at the option of the Owner).
  4. Horizontal Cabling System Voice and Data (Category 6)  
 Note: Data on patch panels, voice on 110 fields.  
 Line map continuity
    - Length
    - Link insertion Loss (formerly attenuation) Less than 31.0 dB @ 250 MHz.
    - Link NEXT/FEXT Pr. To Pr. greater than 38.3 dB @250 MHz.
    - Link NEXT/FEXT PWR. greater than sum 32.7 dB @ 250 MHz.
    - Link ELFEXT Pr. to Pr. 16.2 dB @ 250 MHz.

- Link ELFEXT PWR. greater than sum 13.2 dB @ 250 MHz.
- Return loss 10.0 dB @ 250 MHz.

### 3.7 REPORTS

- A. Upon completion of above tests for all installed cabling and wiring. Contractor is to submit a written report presenting test results, including numerical values where applicable, for all measurements for review prior to demonstration and final "acceptance testing". The report shall also be submitted on a CD in "Excel" format.
- B. With the above report, submit written certification that the installation conforms to specifications, is complete, and is ready for inspection and testing.

### 3.8 GUARANTEES AND WARRANTIES

- A. Contractor shall guarantee the complete wire and cable infrastructure system, in writing, against defects in workmanship and material for a minimum of twenty (20) years after final acceptance. During this time, the entire system must be kept in proper operating condition at no additional labor or material cost to the Owner. The Contractor shall delineate the conditions of this warranty for this period. The Contractor shall ensure that all warranty required actions are included and emphasized in the Contractor's training of Owner's personnel.
- B. Furnish a written guarantee for a period of twenty (20) years from substantial completion.
- C. The structured cabling system shall be covered by the cabling manufacturer's Systimax Application Assurance Warranty for the twenty (20) year period and/or guaranteed by the cable contractor so long as the contractor has been in business for at least five years.
- D. Furnish a letter from the manufacturer of the equipment or manufacturer certification which certifies that the installing Contractor is knowledgeable concerning the installation of equipment specified and qualified to perform such installation so as to ensure that the system will operate to manufacturer's specifications.
- E. Warranty service must be rendered within four (4) hours and all problems resolved within twenty-four (24) hours of notification by the Owner.
- F. The manufacturer of the major components will maintain a replacement parts department and provide test equipment when needed.
  - 1. A complete parts department will be located in a geographical proximity consistent with rendering service within the stated twenty-four-hour period.
  - 2. An ample stock of individual components and equivalent unit replacements will be carried for as long a period as demand warrants. This period will extend beyond the normal life expectancy of the equipment, with ten years being the minimum period.

3. Shipping costs associated with providing required equipment not available in local stock shall be the responsibility of the Contractor.
  
- G. Actions that may void warranty shall be identified and submitted for the Owners approval prior to award of contract.
  
- H. The Contractor shall maintain a fully equipped service organization cable of furnishing adequate repair service to the equipment and shall maintain a spare set of all major parts for the system at all times. All circuit packs and boards, instruments and control sub-systems shall be 100 percent backed up with stock at Contractor's facility.

END OF SECTION 27 13 43



**SECTION 283100  
FIRE ALARM AND DETECTION SYSTEM**

**PART 1 GENERAL**

**1.1 SUMMARY**

- A. This Section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The Fire Alarm System shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm system detection and notification operations.
  - 2. Control and monitoring of door hold-open devices, fire suppression systems, emergency power systems, and other equipment as indicated in the drawings and specifications.

**1.2 SCOPE OF WORK**

- A. The fire alarm system shall be addressable incorporating analog smoke and heat sensors, addressable duct detectors, addressable manual pull stations and flame detectors, and carbon monoxide detectors. The fire alarm control panels shall activate addressable notification devices for the interior and control for the exterior weatherproof horn. The fire alarm system shall contain fiber optics network communications compatible with SimplexGrinnell fire alarm protocol for future connections.

**1.3 ACCEPTABLE EQUIPMENT AND SERVICE PROVIDERS**

- A. Manufacturers: The equipment and service described in this specification are those supplied and supported by SimplexGrinnell, which is the College of the Canyons preferred fire alarm vendor, and represents the base bid for the equipment.
  - 1. Subject to compliance with the requirements of this specification, provide alternate products by one of the following:
    - a. SimplexGrinnell
    - b. Edwards
- B. Being listed as an acceptable Manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications. There shall be no substitution related to the process or technology of equipment listed in this specification.

- C. Alternate products must be submitted to the Owner two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
- D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and NICET Level III certified technicians, and shall maintain a service organization within 50 miles of this project location. The equipment and service provider shall have a minimum of 10 years experience in the fire protective signaling systems industry.

#### 1.4 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following sections apply:
  - 1. Division 26: "Electrical"
  - 2. Division 23: "Heating, Ventilating, and Air Conditioning".
- C. The system and all associated operations shall be in accordance with the following:
  - 1. Requirements of the following Model Building Code: CBC, 2019 Edition
  - 2. Requirements of the following Model Fire Code: CFC NFPA 1, 2018 Edition
  - 3. Requirements of the following Model Mechanical Code: CMC, 2019 Edition
  - 4. NFPA 72, National Fire Alarm Code, 2019 Edition
  - 5. NFPA 70, National Electrical Code, 2017 Edition
  - 6. NFPA 101, Life Safety Code, 2018 Edition
  - 7. NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems, 2018 Edition
  - 8. Local Jurisdictional Adopted Codes and Standards
  - 9. ADA Accessibility Guidelines

#### 1.5 SYSTEM DESCRIPTION

- A. General: Provide a complete, non-coded, addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.

- B. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary. The system shall be capable of 100% on-site programming to accommodate system expansion and facilitate changes in operation. All programming shall be capable of being accomplished via the front panel and via a lap top computer. All software operations shall be stored in a non-volatile programmable memory within the FACP. Loss of primary and secondary power shall not erase the instructions stored in memory.
- C. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. Separate alarm, supervisory and trouble logs shall be provided.
- D. Recording of Events: Record all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout differentiates alarm signals from all other printed indications.
- E. Wiring/Signal Transmission:
1. Transmission shall be hard-wired, using separate individual circuits for each zone of alarm operation or addressable signal transmission, dedicated to fire alarm service only in accordance with fire alarm drawings.
  2. System connections for signaling line circuits shall be Class B, Style 4 and notification appliance circuits shall be Class B, Style Y.
  3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.
- F. Remote Access:
1. FACP shall have the capability to provide Remote Access through a Dial-Up Service Modem.
  2. A personal computer or technician's laptop, configured with terminal emulation software shall have the ability to access the FACP for diagnostics, maintenance reporting and information gathering.
- G. Required Functions: The following are required system functions and operating features:
1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority Two, Supervisory and Trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.

2. Noninterfering: The activation of an addressable device does not prevent the receipt of signals from subsequent activations.
3. Transmission to an approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP indicating the type of device, the operational state of the device (i.e alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. General Alarm: A system general alarm shall include:
  - a. Indication of alarm condition at the FACP and the annunciator(s).
  - b. Identification of the device/zone that is the source of the alarm at FACP.
  - c. Operation of audible and visible notification appliances until silenced at FACP.
  - d. Audible Alarm Notification shall operate as a Temporal Code pattern.
  - e. Shutting down HVAC equipment serving zone where alarm is initiated.
  - f. Transmission of signal to the supervising station.
6. Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, or tamper switch, the system shall operate as follows:
  - a. Activate the system supervisory service audible signal and illuminate the LED at the FACP and the annunciator.
  - b. Pressing the Supervisory Acknowledge key will silence the supervisory audible signal while maintaining the Supervisory LED "on" indicating off-normal condition.
  - c. Record the event in the FACP historical log.
  - d. Transmission of supervisory signal to the supervising station.
7. Alarm Silencing: If the "Alarm Silence" button is pressed, all audible alarm signals shall cease operation.
8. System Reset
  - a. The "System Reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("IN PROGRESS", "RESET COMPLETED") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The

display message shall indicate "ALARM PRESENT, SYSTEM RESET ABORTED."

- b. Should an alarm condition continue, the system will remain in an alarmed state.
9. Drill: A manual evacuation (drill) switch shall be provided to initiate an alarm on the FACP.
  10. Manual Control: Manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble. The "off normal" status shall be clearly identified in plain-language on the FACP alphanumeric display.
    - a. Manual Bypass Control: The ability to perform a manual bypass of selected automatic functions shall be provided.
    - b. Circuit Enable/Disable Control: The system shall have provisions for disabling and enabling each circuit individually for maintenance or testing purposes.
  11. WALKTEST: The system shall have a one person test feature. Enabling the one person test feature at the FACP shall activate the "One Person Testing" mode of the system as follows:
    - a. The city circuit connection and suppression release circuits shall be bypassed for the testing group.
    - b. Control relay functions associated to the testing group shall be bypassed.
    - c. The FACP shall indicate a trouble condition.
    - d. The alarm activation of any initiation device in the testing group shall cause the audible notification appliances to sound a code to identify the device.
    - e. The control panel shall automatically reset itself after signaling is complete.
    - f. Any momentary opening of an initiating or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.

H. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The FACP shall determine the condition of each sensor by comparing the sensor value to the stored values.

2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
  3. Programmable Sensitivity: Photoelectric Smoke Sensors shall have 8 sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
  4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements. The reports shall be viewed on a Maintenance Terminal CRT Display or printed for annual recording and logging of the calibration maintenance schedule.
  5. Peak Value Logging: The FACP shall log the Peak Value of smoke obscuration or degree of temperature for each individual sensor to allow system calibration for maximum response time performance without nuisance alarms based on "actual ambient conditions".
  6. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "ALMOST DIRTY." This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "DIRTY SENSOR" condition shall be indicated at the FACP and subsequently a system trouble is reported to the Supervising Station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "DIRTY SENSOR" condition shall not affect the sensitivity level required to alarm the sensor. If a "DIRTY SENSOR" is left unattended, and its average value increases to a third predetermined value, an "EXCESSIVELY DIRTY SENSOR" trouble condition shall be indicated at the control unit. The FACP shall continuously perform an automatic self-test on each sensor that will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "SELF TEST ABNORMAL" trouble condition.
- I. Fire Suppression Monitoring:
1. Water flow: Activation of a water flow switch shall initiate general alarm operations.
  2. Sprinkler valve tamper switch: The activation of any valve tamper switch shall activate system supervisory operations.
  3. WSO: Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- J. Audible Alarm Notification: By horns in areas as indicated on drawings.

K. Power Requirements

1. The control panel shall receive AC power via a dedicated fused disconnect circuit.
2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic.
3. All circuits requiring system-operating power shall be 24 VDC and shall be individually fused at the control panel.
4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control panel. A green "power on" LED shall be displayed continuously while incoming power is present.
5. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be indicated at the control panel.
6. The system shall support 100% of addressable devices in alarm operated at the same time, under both primary (AC) and secondary (battery) power conditions.
7. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A factory authorized installer is to perform the work of this section.
- B. Each and every item of the Fire Alarm System shall be listed under the appropriate category by Underwriters Laboratories, Inc. (UL), and shall bear the "UL" label.

1.7 MAINTENANCE SERVICE

- A. Maintenance Service Contract: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives.
- B. Basic Services: Systematic, routine maintenance visits on a quarterly basis at times scheduled with the Owner. In addition, respond to service calls within 24 hours of notification of system trouble. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Renewal of Maintenance Service Contract: No later than 60 days prior to the expiration of the maintenance services contract, deliver to the Owner a proposal to provide contract

maintenance and repair services for an additional one-year term. Owner will be under no obligation to accept maintenance service contract renewal proposal.

## 1.8 EXTRA MATERIALS

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
1. Break Rods for Manual Stations: Furnish quantity equal to 15% of the number of manual stations installed; minimum of 6 rods.
  2. Notification Appliances: Furnish quantity equal to 10% of each type and number of units installed, but not less than one of each type.
  3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10% of each type and number of units installed but not less than one of each type.
  4. Detector or Sensor Bases: Furnish quantity equal to 2% of each type and number of units installed but not less than one of each type.
  5. Sensor Bases: Furnish quantity equal to 2% of the number of units of each type installed but not less than one of each type.

## PART 2 PRODUCTS

### 2.1 FIRE ALARM CONTROL PANEL (FACP)

- A. General: Comply with UL 864, "Control Units and Accessories for Fire Alarm Systems".
- B. The following FACP hardware shall be provided:
1. Power Limited base panel with beige cabinet and door, 120-VAC 60-HZ input power.
  2. 250 Addressable point capacity inclusive of inputs and outputs in any combination.
  3. Maximum of 144 points of annunciation where one point of annunciation equals:
    - a. 1 LED output or 1 switch input on a 24 Point I/O module.
  4. Four Class B, Style Y Notification Appliance Circuits (NAC; rated 2A at 24VDC, resistive).
  5. Two form "C" Auxiliary Output Circuits (rated 2A @ 24VDC, resistive), operation is programmable for trouble, alarm, supervisory or other selective control operations. Provide capability for switching up to 2 A @ 120VAC, inductive loads.
  6. Dual Municipal City Circuit Connection for connection to either 24VDC Remote Station (reverse polarity) or local energy.



7. The FACP shall support two RS-232-C ports.
  8. Supervised serial communication channel for control and monitoring of remotely located LCD annunciators and I/O panels.
  9. Modular Network Communications Card.
  10. Common Event DACT
- C. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single panel is required to form a complete control panel, provide exactly matching modular panel enclosures.
- D. Alphanumeric Display and System Controls: Panel shall include an 80 character LCD display to indicate alarm, supervisory, and component status messages and shall include a keypad for use in entering and executing control commands. The fire alarm control panels shall be SimplexGrinnell model 4010-9101 and be listed for suppression.

## 2.2 EMERGENCY POWER SUPPLY

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all notification appliances in alarm or supervisory mode for a period of 5 minutes.

## 2.3 ADDRESSABLE MANUAL PULL STATIONS

- A. Description: Addressable single- or double-action type, red LEXAN, with molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. The manual pull station shall be SimplexGrinnell model 4099-9001.
- B. Protective Shield: Where required, as indicated on the drawings, provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station.

## 2.4 SMOKE SENSORS

- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
1. Factory Nameplate: Serial number and type identification.
  2. Operating Voltage: 24 VDC, nominal.

3. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
  4. Plug-In Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control unit.
  5. Each sensor base shall contain an LED that will flash each time it is scanned by the Control Unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
  6. Each sensor base shall contain a magnetically actuated test switch to provide for easy alarm testing at the sensor location.
  7. Each sensor shall be scanned by the Control Unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135-deg F and 15-deg F rate-of-rise for the heat sensor, but shall indicate a "Wrong Device" trouble condition.
  8. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI.
  9. Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors.
  10. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Type: Smoke sensors shall be of the photoelectric or combination photoelectric / heat type. Photoelectric smoke detectors shall be SimplexGrinnell model 4098-9714.
- C. Bases: Relay output, sounder and isolator bases shall be supported alternatives to the standard base. The standard sensor base shall be SimplexGrinnell model 4098-9792.
- D. Duct Smoke Sensor: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Sensor includes relay as required for fan shutdown.
1. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.

2. The Duct Housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
3. Duct Housing shall provide a relay control trouble indicator Yellow LED.
4. Duct Housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
5. Duct Housing shall provide two (2) Test Ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
6. Duct Housing shall provide a magnetic test area and Red sensor status LED.
7. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover. The addressable duct detector shall be SimplexGrinnell model 4098-9755.
8. Each duct smoke sensor shall have a Remote Test Station with an alarm LED and test switch. The remote test station shall be SimplexGrinnell model 2098-9806.
9. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL Listed to Standard 268A. If required the NEMA 4X weatherproof duct housing enclosure shall be SimplexGrinnell model 4098-9845.

## 2.5 HEAT SENSORS

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
- B. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall be affected by thermal lag.
- C. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and] programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
- D. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F. The analog heat sensor shall be SimplexGrinnell model 4098-9733.

## 2.6 ADDRESSABLE CIRCUIT INTERFACE MODULES

- A. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems. Individual addressable monitoring modules shall be SimplexGrinnell model 4090-9001.
- B. Addressable Circuit Interface Modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
- C. Type 3: Line Powered Control Circuit Interface Module
- D. This module shall provide control and status tracking of a Form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module. Addressable control relay modules shall be Simplex-Grinnell 4090-9002.
- E. All Circuit Interface Modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

## 2.7 NOTIFICATION APPLIANCES DEVICES

- A. Horn Strobes.
  - 1. The horn strobe appliances shall be a Cooper - Wheelock Series AS-24MCW-FR audible or audible visual appliance or equivalent. Horn strobe notification appliance shall be electronic and use solid state components. Electromechanical alternatives are not approved. Each electronic horn appliance shall provide field selectable single stroke or vibrating operation with volume control and tone control. The horn and the strobe shall be able to operate from a single NAC circuit when set to the vibrating mode. The peak anechoic dBA measurement at 10 feet shall be 87dBA minimum, at nominal voltage. Operating voltages shall be 24 VDC for horns and horn strobes using filtered power or unfiltered (VRMS) power supply. All models shall have provisions for standard reverse polarity type supervision and IN/OUT field wiring using terminals that accept #12 to #18 AWG wiring.
  - 2. Combination horn strobe appliances shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid state circuitry that are Sync in one (synchronization requires the Cooper - Wheelock Series DSM-12/24R Sync Module(s)). If the Dual Sync Module(s) contacts fail in the passive state (i.e.,

contacts remain closed) the strobe shall revert to a non-synchronized flash rate of 1 flash per second. Strobe shall meet UL 1971 and produce a flash rate of 1 flash per second minimum over the Listed input voltage (20 VDC-31 VDC) range. The multi candela strobe intensity shall be rated per UL 1971 for 15, 30, 75, or 110 Candela for wall mount applications and 15, 30, 75, 95 candela for ceiling mounted applications.

B. Strobe:

1. The multi-candela Visual notification appliances shall be Cooper - Wheelock Series RSS-24MCW-FR Strobe Appliances. Series RSS shall meet and be Listed under UL Standard 1971 (Emergency Devices for the Hearing Impaired for Indoor Fire Protection Service). The strobes shall be listed for indoor use only. The strobe appliances shall produce a flash rate of one (1) flash per second minimum over the Listed Voltage range of 20 to 31 VDC for 24 volt models. All inputs shall be polarized for compatibility with standard reverse polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP).
2. All visual appliances shall incorporate a Xenon flashtube enclosed in rugged Lexan lens. The RSS Strobes shall be the Low Current Design and shall have Zero Inrush. The strobe intensity shall be rated per UL 1971 for 15, 30, 75 and 110 candela for wall mount applications and 15, 30, 75, 95 candela for ceiling mounting applications. Series RSS appliances shall incorporate circuitry for synchronized strobe flash and shall be designed for compatibility with Cooper - Wheelock Sync Modules. The strobes shall not drift out of synchronization at any time during operation. If the sync module fails to operate (i.e., contacts remain closed), the strobes shall revert to a non-synchronized flash rate.

C. Sync Control Modules:

1. The sync control modules shall be Cooper - Wheelock DSM-12/24R Sync Modules. Sync Modules shall be the master controllers for Cooper - Wheelock #AS-24MFW-FR, and Cooper - Wheelock #RSS-24MCW-FR Strobe products where synchronized only signal is specified. All modules shall be UL listed under Standard 464.
2. Cooper - Wheelock DSM-12/24R modules shall be designed to interface with Cooper-Wheelock Series AS Horn Strobe Appliances to produce a synchronized strobe flash.

## 2.8 EXTERIOR HORNS

- A. The exterior horn shall offer field selectable choice of 2 recognized alerting signals and three installer selectable sound output levels (Low, Medium, and High). The horn shall be capable to be connected to a coded output from the fire alarm control panel. The weatherproof exterior horn shall be Cooper- Wheelock model AH-24WP-R—WP-KIT. CSFM. #7135-0785:141.

END OF SECTION 283100

**SECTION 31 10 00  
SITE CLEARING**

**PART 1 - GENERAL**

1.01 SUMMARY

- A. Contractor shall furnish all labor, materials, services, testing, transportation and equipment necessary for the completion of all site clearing work as required and as indicated on drawings and specified herein. Work materials and equipment not indicated or specified which is necessary for the complete and proper operation of the work of this Section in accordance with the true intent and meaning of the contract documents shall be provided and incorporated at no additional cost to the Owner.
- B. Removal of surface debris; removal of paving and curbs; removal of trees, shrubs, and other plant life; topsoil excavation; and repair of damaged vegetation and/or irrigation systems/system components.
- C. Removal of concrete and bituminous surfacing where applicable.

1.02 RELATED SECTIONS

- A. Section 02 41 19 - Demolition.

1.03 REFERENCE STANDARDS

- A. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2018 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications". In case of conflict between the "Standard Specifications", the General Conditions/Specifications and these Special Provisions, the General Conditions/Specifications and these Special Provisions shall have precedence.

1.04 REGULATORY REQUIREMENTS

- A. The Contractor shall obtain all necessary permits, licenses, or agreements required by any legally constituted agency, pay for all fees and give all necessary notices required for the construction of the work. The College of the Desert shall reimburse the contractor for all necessary permits or inspection fees by any legally constituted agency.
- B. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, County of Los Angeles and the City of Los Angeles. Provide additional measures, added materials and devices as may be needed as directed by the District Representative at no added cost to the District.
- C. Comply strictly to Rule 1404, South Coast Air Quality Management District.
- D. Coordinate clearing Work with utility companies.

## **PART 2 - PRODUCTS**

2.01 Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 02 41 19 – Demolition.

- A. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Verify that existing plant life designated to remain is tagged or identified.
- B. Identify a waste area for placing removed materials.

### **3.02 PROTECTION**

- A. Protect existing structures and site improvements indicated to remain, from damage by approved methods and/or as authorized by the *District Representative*. Removal of all protections shall be when work of this Section is completed or when so authorized by the District Representative.
- B. Protect Existing Utilities indicated or made known to remain traversing the job-site and serving existing adjacent facilities.
- C. Protect Existing Trees and Shrubs indicated to remain by providing temporary surrounding fencing so located a sufficient distance away so that trees and shrubs will not be damaged by site-clearing operations.
  - 1. Protection Barrier: A protection barrier shall be installed around the shrubs or trees to be preserved. The barrier shall be constructed of a durable fencing material, such as plastic construction fencing, snow fence, or chain link. The barrier shall be placed at or beyond the drip line. "Drip line" as referred to herein means a line which may be drawn on the ground around the tree directly under its outermost branch tips and which identifies that location where rainwater tends to drip from the tree. Placement of barrier to be approved by District Representative (Grounds Supervisor). If barrier is placed inside the drip line, then 3/4 inch plywood must be placed over the root zone up to the drip line. The fencing shall be maintained in good repair throughout the duration of the project, and shall not be removed, relocated, or encroached upon without permission of the District Representative (Grounds Supervisor).
  - 2. Storage of Materials: There shall be NO storage of materials or supplies of any kind within the area of the protection barriers. Concrete, cement, asphalt materials, block, stone, sand and soil shall not be placed within the drip line of the tree(s).
  - 3. Fuel Storage: Fuel storage shall NOT be permitted within 150 feet of any tree to be preserved. Refueling, servicing and maintenance of equipment and machinery shall NOT be permitted within 150 feet of protected trees.
  - 4. Vehicles/equipment: NO parking or driving of vehicles or storage of equipment shall be permitted within the drip line of any tree to be preserved.



5. Debris and Waste Materials: Debris and waste from construction or other activities shall NOT be permitted within protected areas. Wash down of Concrete, cement or asphalt handling equipment, in particular shall NOT be permitted within 150 feet of protected areas.
6. Grade Changes: Grade changes can be particularly damaging to trees. Any grade changes should be approved by the District Representative (Grounds Supervisor) before construction begins and precautions taken to mitigate potential injuries.
7. Damages: Any damages or injuries to the preserved trees (including pruning or cutting of such trees not in conformity with the International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards) shall be reported immediately to the District Representative (Grounds Supervisor). Severed roots shall be pruned cleanly to healthy tissue, using proper pruning tools. Broken branches/limbs shall be pruned according to International Society of Arboricultural Pruning Guidelines and ANSI A300 Pruning Standards. In the event that any damage, injury, improper pruning or cutting of a protected tree is deemed to be so substantial as to require its replacement (such determination to be made in the sole discretion of the District Representative), Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.
8. Removal of Existing Tree or Shrub: Prior to removing or cutting any trees designated for removal, the contractor shall coordinate with the District's Ground Supervisor. In the event that Contractor, a Subcontractor, Sub-Subcontractor, material supplier or anyone else performing the Work of the Contract willfully, negligently or mistakenly removes any tree or shrub not designated for removal, Contractor shall immediately report such removal to the District Representative (Grounds Supervisor). Contractor shall replace such tree with the same species and variety of tree, up to a box size of 48 inches, or if no such replacement is available, with a substitute species or variety as determined in the sole discretion of the District Representative. Any replacement tree shall be approved in advance by the District Representative. The value of the tree to be replaced shall be determined by a Certified Arborist selected by Contractor from the District's approved list of Registered Consulting Arborists. To the extent that the value of the replaced tree as determined by the Certified Arborist exceeds the cost of the replacement tree, Contractor shall be liable to District for such difference in value in addition to all costs associated with replacement of the damaged tree.
9. Unauthorized Tree Removal or Injury: Criminal Penalties: Reference is made to California Penal Code §384a which provides that any person who willfully or negligently cuts, destroys, mutilates or removes any tree or shrub or portion thereof growing on public land without a written permit from the owner of said public land is guilty of a misdemeanor, subject to a fine of up to \$1,000, imprisonment in county jail for up to 6 months, or both. Contractor is advised

that, in addition to all remedies provided herein and in the Contract Documents, the District shall cooperate with appropriate authorities in prosecuting and enforcing Penal Code §384a and other criminal sanctions as appropriate concerning trees and shrubs located on District property.

10. Preventive Measures: Before construction begins fertilization of the affected areas to be applied at a rate to be determined by the District Representative (Grounds Supervisor).
- D. Protect bench marks, survey control points, and existing structures from damage or displacement.
  - E. Protection of Persons and Property (existing structures and site improvements):
    1. Provide barricades, warning signs at open depressions and holes on adjacent property and public accesses.
    2. Provide operating warning lights during hours from dusk to dawn each day or as otherwise required.
    3. Protect existing remaining structures, utilities, sidewalks, pavements other facilities from damage as caused by settlement, undermining, washout or other hazards created by site-clearing operations of this Section.
  - F. Use means necessary to prevent dust from becoming a nuisance to the public, to neighbors and to others performing work on or near the job-site.
  - G. Maintain access to the job-site at all times.

### 3.03 CLEARING

- A. Clear areas required for access to site and execution of Work.
- B. Remove all rubbish and debris existing and resulting from work operations of this Section as soon as possible, do not allow to pile up. Do not burn rubbish and debris on the job-site.
- C. Where active utility lines need to be capped or plugged, perform such work in accordance with requirements of the Utility Company.

### 3.04 REMOVAL

- A. Remove debris, rock, and extracted plant life from site.
- B. Excavate and remove associated plumbing piping.
- C. Prior to demolition work, the Contractor shall notify the District Representative to identify the existing items for salvage purposes. The materials identified for salvage shall be returned to the District in a timely manner agreed upon by the District Representative.

### 3.05 CONCRETE AND BITUMINOUS SURFACE REMOVAL

- A. Where noted on the construction drawings, break up and completely remove all existing concrete surfacing, curbs, gutters, walks and bituminous surfacing to limits indicated to be removed. All cutting shall be done to a neat and even line with proper tools or a concrete cutting saw. Minimum depth of cut shall be 1-1/2", unless otherwise specified.

Remove any concrete broken beyond the indicated limits to the nearest joint or score line and replace with new concrete to match the existing.

- B. Removed concrete and bituminous materials shall be disposed of off-site unless otherwise noted on the construction drawings. All such items to be removed shall be disposed of off the property in a legal manner.
- C. Bituminous pavement saw cutting shall conform to the provisions of Section 300-1.3.2 (a) of the Standard Specifications. The residue resulting from the saw cutting operations shall not be permitted to flow beyond the specific work location and shall be removed the same day.
- D. Removal of concrete curb / curb & gutter covered by this section shall include saw-cutting and removal of a twelve (12") inch wide section of the adjacent bituminous pavement.
- E. When saw cutting concrete curb / curb & gutter, the cuttings shall be continuously wet vacuumed to prevent the materials from entering catch basins, storm water conveyances, or waters of the State. Vacuumed cuttings shall be disposed of according to applicable regulations.
- F. Concrete curb and concrete curb and gutter shall be removed to the lines, grades and locations shown on the plans in accordance with Section 300-1.3.2 of the Standard Specifications.
- G. Concrete removal in sidewalk and driveway areas shall extend to existing score lines unless specifically indicated otherwise on the Plans or in the Project Special Provisions, or unless otherwise approved by the Engineer.
- H. Reinforcing or other steel may be encountered in portions of concrete to be removed. No additional compensation will be allowed for the removal of concrete containing reinforcing or other steel.
- I. In those areas where existing bituminous surfacing is removed to make way for new planting or lawn areas, remove soil 6" below existing exposed soil surface. Removed soil may be used only as fill under buildings or other areas to be paved, only if approved by the District Inspector. Legally dispose of off site, if material is not approved as fill material.

### 3.06 REPAIRS

- A. During demolition and construction, ensure that trees, shrubs and other plant material and vegetation are protected inside and outside of the work zone and that the vegetation is being watered, maintaining the proper moisture content according to the season. Failed vegetation, including sod, due to lack of water, and/or plant material destroyed during construction period are to be replaced to equal or better size and condition at no additional cost to the District.
- B. If the irrigation system is damaged or modified during construction, it shall be repaired to the Districts standards, and shall be in equal or better condition than prior to damage or modification. All repairs shall be, inspected and approved by the District Representative (Grounds Supervisor) prior to backfilling or covering of said repairs. The District representative requires forty-eight hours prior notice, when contractor requests inspection of completed repairs. All repairs shall be made so as to ensure proper operation prior to the close of the contract at no additional cost to the District.

- C. Controller Wires: If damaged, cut or removed, repair by splicing, soldering and silicone sealing. To ensure proper operation, reconnect the wires to the valve to correspond with the map on the controller to the correct station.
- D. Hydraulic Tubes: If damaged/cut or removed, repair by replacing the tubing using equal or better material.
- E. Valves: If damaged, repair/replace with equal or better material. All valves are to be flushed/cleaned thoroughly.
- F. Mainlines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.
- G. Lateral Lines: If damaged, repair/replace with equal or better material. All lines are to be flushed/cleaned thoroughly.
- H. Irrigation Heads: If damaged, repair/replace with equal or better material. All heads are to be flushed and filters cleaned thoroughly.
- I. Controllers: If damaged repair/replace with equal or better material.
- J. Backflow Prevention Devices: If damaged, repair/replace with equal or better material.
- K. Gate/Ball/Quick Coupler Valves: If damaged repair/replace with equal or better material.
- L. Valve Boxes: If damaged, repair/replace with equal or better material. Concrete boxes and concrete lids with the appropriate markings for identification shall be used. The top of the box shall be buried below finish grade, equal to existing depth or deeper. The top of the valve stems shall be 6" below the underside of the top of the box.
- M. Construction in grass areas: Sod shall be removed by sod cutting at a soil depth of 2", stored on site, and watered on a daily basis. Upon completion of work, stored sod shall be reinstalled over the areas disrupted due to construction. An option may be to bypass cutting the sod, however at the completion of the project, finish grading and installation of new Hybrid Bermuda GN -1 sod over the areas disrupted by construction shall be required.

### 3.07 EXCESS MATERIALS DISPOSAL

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

### 3.08 SITE CLEANUP

- A. Cleanup of branches, limbs, logs, or any other debris resulting from any operations shall be promptly and properly accomplished. The work area shall be kept safe at all times until all operations are completed. Under no circumstances shall the accumulation of brush, limbs, logs, or other debris be allowed in such a manner as to result in a hazard to the public. All debris shall be cleaned up each day before the work crew leaves the site, unless permission is given by the Owner to do otherwise. All lawn areas shall be raked, all streets and sidewalks shall be swept, and all brush, branches, rocks or other debris shall be removed from the site. Areas are to be left in a condition equal to or better than that which existed prior to the commencement of operations.

## END OF SECTION

**SECTION 31 20 00  
EARTHWORK**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. The work of this section shall include excavation, unclassified cut, unclassified fill, removing existing unsatisfactory material, preparing areas to be filled, spreading and compacting of fill in the areas to be filled, and all other work necessary to complete the grading of the site. It shall be the Contractor's responsibility to place, spread, moisten or dry, and compact the fill in strict accordance with these specifications to the lines and grades indicated on project plans or as directed in writing by the Geotechnical Engineer. Included with this Work are the following:
1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.
  2. Excavating, filling, backfilling, and compacting for Project site pavement, planting areas, buildings, and other structures.
  3. Subbase course for walks and pavements.
  4. Subsurface drainage backfill for walls and trenches.
  5. Excavating and backfilling trenches within buildings lines.
  6. Excavating and backfilling for underground mechanical and electrical utilities and appurtenances.
  7. Shoring plan guidelines.
- B. Related Sections: The following Sections contain requirements that relate to this Section.
1. Section 32 12 16 – Bituminous Surfacing.
  2. Section 32 13 13 - Site Concrete.

**1.02 DEFINITIONS**

- A. Excavation consists of the removal of material encountered to subgrade elevations and the reuse or disposal of materials removed.
- B. Subgrade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- C. Borrow: Soil material obtained off site when sufficient approved soil material is not available from excavations.
- D. Base Course: The layer placed between the subgrade and surface pavement in a paving system.
- E. Drainage Fill: Course of washed granular material supporting slab on grade placed to cut off upward capillary flow of pore water.

- F. Permeable Backfill: Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations.
- G. Unauthorized excavation consists of removing materials beyond indicated subgrade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below ground surface.
- I. Utilities include underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

#### 1.03 SUBMITTALS TO CONSTRUCTION MANAGER

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for the following:
  - 1. Each type of plastic warning tape.
  - 2. Filter fabric.
- C. Samples of the following:
  - 1. 20 lb sample, sealed in air tight container, of proposed drainage fill materials.
  - 2. 12 by 12 inch sample of filter fabric.
- D. Test Reports: In addition to test reports required under field quality control, submit the following:
  - 1. One optimum moisture-maximum density curve for each soil sample.
  - 2. Laboratory analysis of each soil material proposed for fill or backfill from borrow sources.
- E. Excavation support & protection (shoring) shop drawings for informational purposes: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

#### 1.04 QUALITY ASSURANCE

- A. Codes and Standards:
  - 1. 2019 California Building Code, Title 24, Part 2, Volume 2 of 2, Appendix J, Grading.
  - 2. ASTM D422 - Method for Particle Size Analysis of Soils
  - 3. ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

4. ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) and 18-inch (457-mm) Drop.
  5. ASTM D2216 - Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil Aggregate Mixtures.
  6. ASTM D2922 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
  7. ASTM D3017 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depths).
  8. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  9. AASHTO T217 - Determination of Moisture in Soils by Means of a Calcium Carbide Gas Pressure Meter.
  10. ASTM D4829 - Expansion Index Test.
- B. For off-site work, conform to all requirements of City of Pasadena and any other agencies having jurisdiction. Coordinate and obtain all required permits and inspections.
  - C. The work provided herein shall conform to and be in accordance with the Contract Plans, General Conditions/Specifications and Special Provisions, as well as the Standard Specifications for Public Works Construction ("GREENBOOK"), 2009 Edition, adopted by the Southern California Chapter, American Public Works Association; herein referred to as the "Standard Specifications". In case of conflict between the "Standard Specifications", the General Conditions/Specifications and these Special Provisions, the General Conditions/Specifications and these Special Provisions shall have precedence.
  - D. Comply with all requirements of permit for export of soil from site. Permit is to be obtained and paid for by Contractor. Furnish copies of all permits and licenses required by the City of Pasadena to Owner's representative.
  - E. Professional Observation: A soils engineer will be retained by the Owner for purposes of inspection, testing and approval of all work under this section. Perform work of this Section under inspection and approval of the soils engineer. Give soils engineer not less than 48 hours advance notice of readiness for inspection.
  - F. The soils engineer will have the authority over all filling, grading, and compaction operations, including interruption of work if deemed necessary due to improper work
  - G. Pre-Grading Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."
    1. Before commencing earthwork operations, meet with representatives of the governing authorities, Owner, Architect, consultants, Geotechnical Engineer, independent testing agency, and other concerned entities. Review earthwork procedures and responsibilities including testing and inspection procedures and requirements. Notify participants at least 3 working days prior to convening conference. Record discussions and agreements and furnish a copy to each participant.

## 1.05 CONSTRUCTION MONITORING

- A. All earthwork and foundation construction should be monitored by a qualified engineer/technician under the supervision of a Geotechnical Engineer, including;
  - 1. Observation of all site preparations;
  - 2. Observation of shoring installation, if needed;
  - 3. Observation of all site excavations;
  - 4. Test and approval of all import soil;
  - 5. Observation of placement of all compacted fills and backfills;
  - 6. Observation of all surface and subsurface drainage systems;
  - 7. Observation of all foundation and pile excavations;
  - 8. Observation of subgrade preparation for paved and building areas.
- B. The Geotechnical Engineer of Record should be notified at least three (3) days in advance of the start of construction. A joint meeting between the Contractor and Geotechnical Engineer is recommended prior to the start of construction to discuss specific procedures and scheduling. The Geotechnical Engineer should be present to observe the soil conditions encountered during construction, to evaluate the applicability of the recommendations presented in the Soils Report to the soil conditions encountered, and to recommend appropriate changes in design or construction if conditions differ from those described herein. The Geotechnical Engineer of Record should inspect and approval all imported backfill material prior to its placement as backfill, approve the subgrade beneath all fills, fill placement and bottom of all foundation excavations before concrete or steel is placed.
- C. The Geotechnical Engineer shall submit compaction reports to the Construction Manager and the Civil Engineer at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Engineer shall keep the Construction Manager informed on the progress of the grading work.

## 1.06 IMPORT AND EXPORT OF EARTH MATERIALS

- A. Fees: Pay as required by government authority having jurisdiction over the area.
- B. Bonds: Post as required by government authority having jurisdiction over the area.
- C. Hauling Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

## 1.07 TRUCK HAUL ROUTE

- A. A proposed truck haul route is to be submitted to the City of Pasadena Public Works Department for review and approval. Upon approval, an approved copy shall be returned to the Contractor. The Contractor shall post an approved copy on the job site. All trucks working that project shall also carry a copy. If a truck(s) is found not to be carrying an approved copy, the Contractor shall be subject to a Notice of Noncompliance (stop work order)



- B. All trucks must cover their dirt with an acceptable tarp during transport for dust containment. Provisions for street sweeping and watering will also be required unless an active wheel washing facility proves that they are un-necessary to the satisfaction of the Engineer.
- C. All truck haul routes, as approved, are good only for the project time period, and trucks shall have to comply with the approved route only. If during the progress of the project an alternate route is needed, the Contractor shall submit a new plan. The haul route application shall contain the following information:
  - 1. Map showing the proposed route
  - 2. Project name
  - 3. Grading Contractor's name, address and phone number
  - 4. Type of material being hauled
  - 5. Encroachment or construction permit number

#### 1.08 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.

#### 1.09 PROJECT CONDITIONS

- A. Data: Maps, boring logs, geotechnical and foundation investigation reports, and like reference data, not included in Contract Documents but made available to Contractor by Architect or Owner are for information only, and the Architect and Owner assume no responsibility for any conclusions Contractor may draw from such information. Should questions or issues arise, contact Architect or Owner for clarification.
- B. Contractor shall determine existing conditions under which the Contractor will operate in performing the Work
- C. A geotechnical investigation report prepared by Hydrologue, Inc. (Project No. 4027-00), dated October 25, 2011 has been prepared. Prior to bidding or performing the work of

this project, contractor shall obtain a copy of this report, and shall thoroughly familiarize himself/herself with its contents. Any information obtained from such report, or any information given on any drawings as to subsurface soil conditions or to elevations of existing elevations or elevations of underlying rock, is approximate only, is not guaranteed, and does not form a part of the contract, unless specifically referenced in the Contract Documents. The Contractor is required to make a visual inspection of the Project Premises and must (and is permitted to) make whatever tests the Contractor deems appropriate to determine and assess the underground condition of the soil. No claims for allowances or damages because of the Contractor's negligence or failure in acquainting itself with the conditions of the Project Premises as described herein will be recognized by the District.

- D. WARNING: DISTRICT DOES NOT WARRANT THE SOILS AT THE PROJECT SITE. SOILS INVESTIGATION REPORT IS PROVIDED FOR CONTRACTORS INFORMATION ONLY. CONTRACTOR HAS CONDUCTED AN INDEPENDENT INVESTIGATION OF THE PROJECT SITE AND THE SOILS CONDITIONS OF THE SITE. DISTRICT DOES NOT WARRANT THE SOILS CONDITIONS OF THE SITE AND CONTRACTOR IS FULLY RESPONSIBLE TO ASCERTAIN SITE CONDITIONS FOR THE PURPOSES OF DETERMINING CONSTRUCTION MEANS AND METHODS PRIOR TO COMMENCING CONSTRUCTION. THE SOILS INVESTIGATION REPORT IS NOT A CONTRACT DOCUMENT.
- E. Information on Drawings does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
- F. Existing utilities: Locate existing underground utilities in all areas of work prior to excavation or commencement of work. If utilities are to remain in place provide adequate means of protection during earthwork operations.
  - 1. Should uncharted, or incorrectly charted piping or other utilities be encountered during excavation, consult Utility Owner immediately for direction. Cooperate with Owner and Utility companies in keeping respective services and facilities in operation. Repair damaged utilities to the satisfaction of Utility Company.
  - 2. Do not interrupt existing utilities serving facilities occupied or used by Owner, or others, except when permitted in writing by Owner's Representative, and then only after acceptable temporary services have been provided.
  - 3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut off of services if lines are active.
- G. 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.
- H. Water for Grading: Contractor shall obtain and pay for all water required for his grading operation. 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.
- I. Existing Conditions: Prior to commencing work at site, verify agreement of existing conditions with indicated conditions. Notify Owner's Representative in writing of

discrepancies found. Start of work without notification constitutes acceptance of conditions, without cause for extra compensation.

- J. Field obstructions, grade differences or differences in dimensions may exist that might not have been considered or observed during design of this project. Contractor shall promptly notify the Engineer and the Agency having jurisdiction by telephone and in writing upon discovery of and before disturbing, any physical conditions differing from those represented by approved plans and specifications. In the event this notification is not performed, the Contractor shall assume full responsibility for necessary revisions.

## **PART 2 - PRODUCTS**

### **2.01 SOIL MATERIALS**

- A. General: All soils materials to be used throughout the site shall be approved for use by the Geotechnical testing engineer. Provide approved borrow soil materials from off site when sufficient approved soil materials are not available from excavations.
- B. No earthwork analysis has been completed with respect to the volumes of soils to be excavated, placed, or imported in order to provide the finished grades shown on the plans. The Contractor is solely responsible for verifying the earthwork quantities necessary to complete the project.
- C. For earthwork volume estimating purposes, an average shrinkage volume of 10 to 15 percent and subsidence of 0.1 to 0.2 foot may be assumed for the surficial soils. See page 13 of the project Geotechnical Investigation Report.
- D. Satisfactory Soil Materials: Soils approved by the testing geotechnical engineer and free of rock or gravel larger than 3 inches in any dimension, debris, waste, vegetation and other deleterious matter and as approved by the Geotechnical Engineer. Rocks or hard lumps larger than approximately 3 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.
- E. Borrow / Imported Fill Material: Soil excavated from site or imported conforming to requirements for fill material.
  - 1. 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.
  - 2. Imported materials should have a Plasticity Index (PI) not less than 12 nor greater than 15, as determined by ASTM D 4318; and expansion index not exceeding 35, as determined by ASTM D 4829; and have 100% passing a two inch sieve, 60% to 100% passing a #4 sieve, no more than 20% passing a #200 sieve.
- F. 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.
- G. Base Course Material For Use Under Asphalt Pavement: Crushed base material shall consist of materials that meet the provisions listed below.

1. Crushed Aggregate Base (CAB) per Section 200-2.2, 3/4" maximum of the Standard Specifications for Public Works Construction (Green Book).
  2. Crushed aggregate base (CAB) shall consist of native rock without naturally occurring asbestos or recycled materials. The Contractor shall submit written documentation, which identifies the source, volume, and proposed transport date of the material for review and approval by the Owner's Construction Manager prior to importing the material. A statement on company letterhead from the source, stamped by either a California Professional Geologist or Engineer, which states that the subject materials are native rock, do not contain any recycled materials and that the source does not mine ultramafic materials, a source of natural occurring asbestos shall be included in the submittal to Owner's Construction Manager.
- H. Engineered Fill: Satisfactory Soil Materials / Borrow Fill Material, as described above, placed in lifts no greater than 3 inches thick (loose measurements) unless approved by the Geotechnical Engineer, and compacted to a minimum of 95% in accordance with ASM D1557. See page 12 of the approved soils report for this project.
- I. Bedding Material for Trenches:
1. Bedding sand shall be as defined by Standard Specifications, Section 200-1.5, and shall be free of expansive material and organic matter. Bedding material for utility lines outside the property lines shall be as required by the agency having jurisdiction. On-site soils are not considered suitable for bedding or shading of utilities.
  2. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour. All of the sand bedding shall be compacted to 90 percent of maximum density as indicated in the Contract Documents by mechanical means. Flooding and jetting shall not be permitted without prior written approval from the Geotechnical Engineer. Pipe bedding material shall be placed in horizontal layers not exceeding (8) eight inches.
- J. Backfill Material for Trenches:
1. The on-site soils may be used for backfilling utility trenches from 6 inches 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. Where Construction Documents indicate areas of backfill requiring cement-sand slurry, the material requirements in Section 32 13 13: Site Concrete shall be followed.
- K. Gravel Fill Material: Shall be from an approved source, having the following gradation: 90-100% passing a 3/4" sieve, 0% to 10% passing a No. 4 sieve, and 0% to 3% passing a No. 100 sieve.
- L. Filter Fabric: Manufacturer's standard nonwoven geotextile fabric of polypropylene geotextiles, "Mirafi 140N" or approved equal

1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
  - a. Grab Tensile Strength (ASTM D 4632): 100 lb.
  - b. Apparent Opening Size (ASTM D 4751): #70 U.S. Standard sieve.
  - c. Permeability (ASTM D 4491): 135 gallons per minute per sq. ft.

## 2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid and alkali-resistant polyethylene film metallic warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick minimum, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.
  1. Tape Colors: Provide tape colors to utilities as follows:
    - a. Red: Electric.
    - b. Yellow: Gas, oil, steam, and dangerous materials.
    - c. Orange: Telephone and other communications.
    - d. Blue: Water systems, with "Caution: Water Line Below."
    - e. Green: Sewer systems, with "Caution: Sewer Line Below."
    - f. Green: Storm systems, with "Caution; Storm Drain Line Below."
- B. Filter Fabric: Manufacturer's standard nonwoven geotextile fabric of polypropylene geotextiles, "Mirafi 140N" or approved equal.
  1. Provide filter fabrics that meet or exceed the listed minimum physical properties determined according to ASTM D 4759 and the referenced standard test method in parentheses:
    - a. Grab Tensile Strength (ASTM D 4632): 100 lb.
    - b. Apparent Opening Size (ASTM D 4751): #70 U.S. Standard sieve.
    - c. Permeability (ASTM D 4491): 135 gallons per minute per sq. ft.

## 2.03 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN

- A. The CONTRACTOR shall have at the Worksite, copies or suitable extracts of: Construction Safety Orders, Tunnel Safety Orders and General Industry Safety Orders issued by the State Division of Industrial Safety. The CONTRACTOR shall comply with provisions of these and all other applicable laws, ordinances, and regulations.
- B. Before excavating any trench 1.5m (5 feet) or more in depth, the CONTRACTOR shall submit a detailed plan to the Owner showing the design of shoring, bracing, sloping, or other revisions to be made for the Workers' protection from the hazard of caving ground during the excavation of such trench. If the plan varies from the shoring system standards, the plan shall be prepared by a registered Civil Engineer. No excavation shall

start until the OWNER has accepted the plan and the CONTRACTOR has obtained a permit from the State Division of Industrial Safety. A copy of the permit shall be submitted to the OWNER.

- C. The INSPECTOR will provide a competent person trench/excavation certification form to the CONTRACTOR. It shall be completely filled out before any worker has access to trench or excavation and returned to the INSPECTOR before the end of the first working day. The CONTRACTOR shall certify by this form the name of the competent person administering the Work, the soil classification, and the type of excavation protective system provided and/or installed.
- D. The CONTRACTOR shall completely fence all excavations to provided protection against anyone falling into the excavation and to the satisfaction of the INSPECTOR. The fencing shall be in place at all times except when workers are present and actual construction operations are in progress.
- E. The fencing material shall be chain link fabric or welded wire fabric (6x6-W9xW9 minimum) and 1.5 m (5 feet) high, constructed according to one of the following:
  - 1. Tensioned fencing material and have top and bottom tension wires securely fastened to driven steel posts or other equally rigid elements at a maximum spacing of 3.6m (12 feet); or
  - 2. Untensioned fencing materials securely fastened to extended trench shoring elements at a maximum spacing of 2.4m (8 feet) and fastened to continuous top and bottom rails constructed of nominal 50mm x 100mm (2 in x 4 in) lumber or equally rigid material. Framed panels with suitable supporting elements fastened together to form a continuous fence may also be used.
- F. Payment for performing all work necessary to provide safety measures shall be included in the prices bid for other items of work except where separate bid items for excavation safety are provided, or required by law.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- A. Protect adjacent property and existing improvements and structures as necessary to prevent undermining, caving of cuts, and miscellaneous damage.
- B. Provide cribbing, sheeting, and shoring necessary to safely retain the earth banks and protect excavations and adjoining grades from caving and other damage resulting from excavating together with suitable forms of protection against bodily injury to personnel employed on the work and the general public. Be responsible for the design, installation, and maintenance of required cribbing and shoring and shall meet the approval of the State Division of Industrial Safety and local governing agencies requirements.
- C. Utility lines and structures shown shall be protected and treated as indicated. Where work not shown is encountered, report it to the Architect before proceeding with excavation. Encase active lines in sleeves where they pass through concrete; remove inactive lines as directed, and plug the remaining ends. Bear the costs for repairs to damaged or broken utilities and any damages related thereto.
- D. Protect existing improvements and adjacent properties from storm damage and flood hazard originating on this project until final acceptance by the Owner. Prevent silt run-off from the limits of work in accordance with governmental requirements.

- E. An 8 foot high, temporary chain link fence with visual screen and gates, (pair 26' wide, minimum) shall be erected prior to any grading operations at the construction limits perimeter. Coordinate the exact location with Architect and District.

### 3.02 DEWATERING

- A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area. Any water entering an excavation shall be immediately pumped out and the exposed excavation allowed to dry.
- B. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

### 3.03 GRADE STAKES

- A. The Contractor's Surveyor will set grade stakes. The Surveyor shall be a California registered land surveyor or licensed Civil Engineer. The Surveyor shall be hired and paid by the Contractor, and shall be subject to the approval of the Owner. Contractor shall notify the Owner at least 48 hours before staking is to be started. The Owner will determine if work is ready for staking.
- B. All work shall conform to the lines, elevations, and grades shown on the Construction Plans. Three consecutive points set on the same slope shall be used together so that any variation from a straight grade can be detected. Any such variation shall be reported to the Engineer. In the absence of such report, the Contractor shall be responsible for any error in the grade of the finished work.
- C. Protect and maintain stakes in place until their removal is approved by the Owner. Grade or location stakes lost or disturbed by Contractor, shall be reset by the Surveyor at the expense of Contractor.
- D. Grades for underground conduits will be set at the surface of the ground. The Contractor shall transfer them to the bottom of the trench.

### 3.04 EXCAVATION

- A. All undocumented fill soil encountered during site grading in the areas of building and other improvements, as well as any native soils disturbed during demolition and clearing operations, should be excavated full depth under the observation and confirmation by the Geotechnical Consultant. Lateral extent of overexcavation beyond building perimeter, where possible, should be to a minimum distance equal to the depth of undocumented fill/disturbed soil encountered or five (5) feet, whichever is greater.
- B. It is recommended that the existing on-site soil within the footprint of the building pad be overexcavated and removed uniformly to a minimum depth of three (3) feet below existing or finish grade, or five (5) feet below the bottom of the lowest footing, whichever is lower, and replaced with properly compacted fill such that the building foundations and slabs are supported on a re-engineered, compacted general fill layer.
- C. In preparation for grading, the construction areas should be cleared of surface vegetation, concrete, pavement and any loose surficial soils. Any unsuitable material encountered should be properly disposed of and not incorporated into any new fill.
- D. Excavate to the depths, lines and grades indicated on the approved Grading Plan. Excavate sufficiently over-size to permit installation and removal of concrete forms and

other required work. Should soil of inadequate density and bearing capability be encountered at the elevations indicated on the drawings, or where new fill is to be placed upon existing loose fill material exposed by excavation, the excavation shall be carried to the depth required to attain soil of bearing quality as determined by the Geotechnical Engineer.

- E. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement and concrete pavement structural sections, have been achieved prior to re-compaction.
- F. Should footing excavations exceed required dimensions or should sloughing occur, fill such extra space with concrete at no additional cost to the contract. If unsuitable material is found at the indicated depths, immediately notify the Inspector.
- G. Notify the Inspector 48 hours before foundation excavations are ready for inspection.
- H. The bottoms of footings shall be free of loose material, debris, and water before concrete is placed.
- I. Cut banks shall be neatly trimmed to the required finish surface as the cut progresses, or the Contractor shall have the option of leaving the cuts full and finish grading by mechanical equipment which shall produce the finish surfaces as shown on the Drawings.
- J. Surplus earth not needed for filling and grading shall be disposed of in a legal manner off the site.
- K. All applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health Act of 1970, and the Construction Safety Act should also be followed.

### 3.05 HAZARDOUS MATERIALS

- A. All import fill material shall be characterized, handled, and documented in accordance with applicable US EPA and State of California hazardous waste and hazardous materials regulations.
- B. "Contaminated" shall mean any soil or geotechnical material at a concentration, which would require disposal at a regulated facility (i.e., California hazardous or RCRA hazardous).
- C. Owner's Authorized Representative (OAR) must be notified at least 72 hours prior to the disposal of any hazardous waste or hazardous material. No material disposal or reuse can take place without prior written approval of the OAR.
- D. Replacement of earth material, that has been removed due to hazardous waste reasons, shall be placed back to meet the requirements of Section 2.1, F – Engineered Fill.

### 3.06 EXCAVATION FOR ASPHALT PAVING AND SITEWORK CONCRETE

- A. Refer to Site Concrete Specification 32 13 13 section 3.01 requirements.
- B. Refer to Asphalt Paving Specification 32 12 16 section 3.2 requirements:
- C. The compacted surface shall be firm, hard and unyielding. The term "firm, hard and unyielding" as used in the Standard Specifications Section 301-1.3 shall mean that when



the heaviest construction and hauling equipment used on the project drives over the subgrade, no permanent deformation shall occur either before or during pavement construction. On areas where the underlying material appears to be wet or soft, or where it deflects under wheel loads, the Contractor shall employ excavation and work techniques which do not worsen the subgrade condition.

- D. The above subgrade preparation recommendations are based on the assumption that soils encountered during field exploration are representative of soils throughout the site. However, there can be unforeseen and unanticipated variations in soils between points of subsurface exploration. For this reason, the actual scarification and over-excavation depths will have to be determined on the basis of in-grading observations and testing performed by representatives of the Owner's geotechnical consultant.
- E. Whenever batch trucks or other paving equipment cause rutting of the subgrade or subbase in asphalt or concrete placement areas, inspectors shall immediately stop construction. Construction shall not be allowed to resume until distorted subgrade or subbase is repaired. Contractors and inspectors should locate by proof rolling, any questionable unstable areas in advance to avoid distortion under equipment. Wet, unstable areas must be dried out or replaced before starting placement of asphalt. Locating wet or soft areas in advance can be accomplished by testing finished subgrade or subbase with a loaded truck. Construction of asphalt or concrete pavement should not proceed unless testing gives a reasonable indication that distortions will not occur during construction of overlying pavement. When repair, aeration, and recompaction are required to correct damage from Contractor's operation, all necessary repair will be done at Contractor's expense. However, if the Engineer determines that additional depth of aeration and recompaction are needed, that should be paid by change order.
- F. A California Licensed Surveyor (LS) must provide grade stakes and elevations for the Geotechnical Engineer to verify that the over-excavation depths, shown on the construction drawings for asphalt concrete pavement and sitework concrete structural sections, have been achieved prior to re-compaction.
- G. Subgrade tolerances: Subgrade for pavement shall not vary more than 0.02' from the specified grade and cross section established by the Engineer. Subgrade for base material shall not vary more than 0.04' from the specified grade and cross section. Variations within the above specified tolerances shall be compensating so that the average grade and cross section specified are met.

### 3.07 EXCAVATION, BACKFILL & COMPACTION FOR UTILITIES

- A. Field conditions may require deviations from information indicated on Drawings. Such changes in work shall be covered by a Change Order, indicating an increase or decrease in the Contract sum.
- B. Before excavation, Contractor shall contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.
- C. When connections are to be made to any existing pipe, conduit, or other appurtenances, the actual elevation or position of which cannot be determined without excavation, the Contractor shall excavate for, and expose, the existing improvement before laying any pipe or conduit. The Engineer shall be given the opportunity to inspect the existing pipe or conduit before connection is made. Any adjustments in line or grade which may be necessary to accomplish the intent of the plans will be made, and the Contractor will be paid for any additional work resulting from such change in line or grade.

- D. Trenches, ditches, pits, sumps, and similar items which are outside the barricaded working area shall be barricaded to conform to Cal OSHA standards.
- E. Trenches over 5'-0" in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety, see Section 2.3 EXCAVATION SUPPORT & PROTECTION – SHORING PLAN.
- F. Safe and suitable ladders which project 2 feet above the top of the trench shall be provided for all trenches over 4 feet in depth. One ladder shall be provided for each 50 feet of open trench, or fraction thereof, and be so located that workers in the trench need not move more than 25 feet to a ladder.
- G. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.
- H. All trenches should be backfilled with approved fill material compacted to relative compaction of not less than 90 percent of maximum density determined in accordance with ASTM D 1557. Backfill shall be placed in layers not exceeding 8" (inches) in thickness.
- I. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.
- J. Do not excavate trenches parallel to footings closer than 18" from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9" above bottom of footings.
- K. If soft, spongy, unstable, or other unsuitable material is encountered upon which the bedding material or pipe is to be placed, this material shall be removed to a depth ordered by the Engineer and replaced with bedding material suitably densified. Additional bedding so ordered, over the amount required by the Plans or Specifications, will be paid for as provided in the Bid. If the necessity for such additional bedding material has been caused by an act of failure on the part of the Contractor or is required for control of groundwater, the Contractor shall bear the expense of the additional excavation and bedding.
- L. Unless indicated otherwise on the plans are within this specification, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Maximum allowances at the sides for trenching shall be 12 inches. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.
- M. Where portions of existing structures, walks, paving, etc. must be removed or cut for pipe or conduit installation, replace the material with equal quality, finished to match adjacent work.
- N. Provide a minimum clear dimension of 6 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.

- O. DO NOT place backfill until the bedding and pipe work installed has been inspected, tested and approved by the Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.
- P. Backfill shall be placed in layers not exceeding 8" (inches) in thickness and compacted to 95% for sand and silts and 90% for clayey soils, unless otherwise directed by the Geotechnical Engineer.
- Q. If materials excavated from the Project site are not permitted for trench backfill in paved areas or as specified in Contract Documents, backfill trenches with a one sack cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.
- R. Bedding zone shall be defined as the area containing the material specified that is supporting, surrounding, and extending to 12" (inches) above the top of pipe. Compaction requirements in this area must meet 90%.
- S. Bedding material shall first be placed on a firm and unyielding subgrade so that the pipe is supported for the full length of the barrel. There shall be 6" (inch) minimum of bedding below the pipe barrel and 1" (inch) clearance below a projecting bell for sewer, storm drain and water pipe. The material in the bedding zone shall be placed and densified by mechanical compaction only.
- T. Mechanically compacted backfill shall comply with section 306-1.3.2 of the Standard Specifications for Public Works Construction.
- U. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.
- V. Fill voids with approved backfill materials as shoring bracing and sheeting is removed.

### 3.08 INSPECTION & TESTING AT TRENCHES

- A. Pipe will be inspected in the field before and after laying. If any cause for rejection is discovered in a pipe after it has been laid, it shall be subject to rejection. Any corrective work shall be approved by the Engineer and shall be at NO cost to the Owner.
- B. The Inspector or Geotechnical Engineer will inspect all subgrades and excavations prior to placing bedding & backfill materials.
- C. DO NOT place backfill until the bedding and pipe work installed has been inspected, tested and approved by the Inspector. Remove excavated rocky material unsuitable for backfill from the site prior to final backfilling.
- D. Utility backfill compaction test shall be performed in accordance with ASTM D1557, method "C".
- E. Utility backfill in place density test per ASTM D 1556 (sand cone) or other test method as considered appropriate by the Geotechnical Engineer.
- F. Hydrostatic pressure tests shall be done only after backfill has been placed and final compaction has been achieved.

### 3.09 APPROVAL OF SUBGRADE

- A. Notify Geotechnical Engineer when excavations have reached required over-excavation subgrade.

- B. When Geotechnical Engineer determines that unforeseen unsatisfactory soil is present, continue work only after receiving direction from the Contracting Officer.
- C. Reconstruct subgrades damaged by rain, accumulated water or construction activities as directed by the Soils Engineer.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill of unauthorized excavation below bottoms of foundations or wall footings will be engineered fill.
- B. Fill unauthorized excavations under other construction as directed by the Soils Engineer.
- C. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Geotechnical Engineer.

### 3.11 STORAGE OF SOIL MATERIALS

- A. After the site has been stripped of all debris, vegetation and organic materials, excavated on site soils may be reused as engineered fill provided they meet the satisfactory soils material conditions in Section 2.1, part B. High in-site moisture contents will require aeration prior to placement as engineered fill.
- B. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees. Cover to prevent wind-blown dust.

### 3.12 PLACEMENT OF ENGINEERED FILL

- A. Preparation of the bottom of the excavation:
  - 1. Where structural foundations, slab on grade construction, asphalt pavement and concrete flatwork engineered fill is to be placed, the upper 6" (inches) of native soil must be scarified, moisture conditioned and re-compacted to a minimum of 90 percent of the maximum dry unit weight as determined by the ASTM Test Method D1557.
- B. Spreading and Compacting Fill Material:
  - 1. 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. Engineered fill should have no particles greater than 3 inches in diameter, be placed in lifts no greater than 8 inches thick (loose measurements) and re-compacted to a minimum 95% of the maximum density obtainable by ASTM D1557.
  - 2. After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to the specified density. Compaction shall be accomplished by sheepsfoot rollers; vibratory rollers; multiple-wheel, pneumatic-tired rollers; or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area, and the equipment shall make sufficient passes to obtain the desired density uniformly. Jetting, puddling and hydroconcolitation techniques shall not be used.

3. When backfilling and compacting behind retaining walls and flexible retaining structures, the Contractor shall use lightweight compaction equipment such as hand-operated equipment, shoring, or other means to avoid over-stressing structural walls. When using lightweight compaction equipment, the fill materials shall be spread in horizontal layers not greater than 6 inches thick, measured before compaction.

C. Compaction Testing:

1. The Geotechnical Engineer's representative shall observe the excavation, filling, and compacting operations and shall make density tests in the fill material so that he can state his opinion as to whether or not the fill was constructed in accordance with the specifications. If the surface is disturbed, the density tests shall be made in the compacted materials below the disturbed zone. When these tests indicate that the density or moisture content of any layer of fill or portion thereof does not meet the specified density or moisture content, the particular layer or portions shall be reworked until the specified density and moisture content have been obtained.
2. Sampling and testing of materials for determination of compliance with the specified compaction requirements will be conducted by the Geotechnical Engineer's representative at any location and time as the Owner may determine.
3. The Contractor shall be responsible for excavation of the test pits and for providing and installing any shoring, ladders, or other equipment necessary to protect the testing personnel. The Contractor shall also suspend operations as necessary and at no cost to the owner for the purpose of conducting such testing.
4. Test pits shall be excavated in the backfill by the Contractor as directed by the Engineer for the purpose of testing the backfill compaction. At the option of Engineer, density tests may be taken on a lift of compacted backfill immediately before placing the next lift.
5. Any settlement noted in backfill, fill, or in structures built over the backfill or fill within the one-year warranty period will be considered to be caused by improper compaction methods and shall be corrected at the Contractor's expense. Structures damaged by settlement shall be restored to their original condition by the Contractor at the Contractor's expense.
6. When initial compaction testing performed by the Engineer indicates the required density has not been obtained, the Contractor shall re-compact or replace the backfill as necessary to meet the specified minimum density.
7. The Contractor shall be responsible for rescheduling compaction testing with the Engineer and shall bear all costs for subsequent retesting in the areas of noncompliance. Costs associated with retesting and scheduling delays shall be the sole responsibility of the Contractor. The Engineer will deduct the costs for testing of materials and work found to be unacceptable, as determined by the tests performed by the Owner and the costs for testing of material sources identified by the Contractor which are not used for the work, from moneys due or to become due to the Contractor. The amount deducted will be determined by the Engineer.

### 3.13 BACKFILL - GENERAL

- A. Backfill excavations promptly, but not before completing the following:
  - 1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for record documents.
  - 3. Testing, inspecting, and approval of underground utilities.
  - 4. Concrete formwork removal.
  - 5. Removal of trash and debris from excavation.
  - 6. Removal of temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

### 3.14 GRADING

- A. Rough & Fine Grading: Rough grade area sufficiently high to require cutting by fine grading.
- B. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between existing adjacent grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.
  - 3. Grade area for paving to a depth below finish grades indicated, equal to base and pavement thickness to be constructed.
  - 4. Cut banks neatly to required finish grades as cut progresses, or leave cuts full and finish grading by mechanical equipment, which will produce finish grades indicated on Drawings.
  - 5. Grade filled banks full and compact beyond grade of finish bank so that when trimmed to finish grades, soil is compacted to density specified for final slope face.
  - 6. Bring areas to be graded to approximate finish grades and then scarify, moisten and roll to obtain required density. Scarify, moisten and roll resulting high and low areas to obtain required finish grades by cutting and filling.
  - 7. Grade future planting areas so that, upon cultivation and fertilization, they will conform to finish grades indicated for planting areas.
  - 8. Protect all utilities.
- C. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Building pad tolerance plus or minus ½ inch (0.05-foot).
  - 2. Lawn or Unpaved Areas: Plus or minus (0.10-foot).
  - 3. Walks: Plus or minus (0.04-foot).
  - 4. Pavements: Plus or minus (0.04-foot).

- D. Grading Inside Building Lines: Finish subgrade to a tolerance of ½ inch when tested with a 10-foot straightedge.

### 3.15 FIELD QUALITY CONTROL

- A. A Geotechnical Engineer, designated by the Owner, will be engaged to perform continuous inspection of the placing and compacting of all fills and backfills within the limits of grading of this project. All work shall be done in accordance with the approved plans and these specifications and as recommended and approved by the Geotechnical Engineer. Revised recommendations relating to conditions differing from the approved soils engineering and engineering geology reports shall be submitted to the owner, inspector, architect and the civil engineer. Costs for all such inspections and tests shall be paid by the Owner. The Contractor shall be responsible for notifying the Geotechnical Engineer in advance so that he may be present to perform his services as needed.
- B. The Geotechnical Engineer shall submit compaction reports to the Construction Manager and the Architect at the completion of the work, including test results and plot plans indicating the locations from which the tested samples of fill were taken. The Geotechnical Engineer shall keep the Construction Manager informed on the progress of the grading work.
- C. Testing Agency Services: Allow testing agency to inspect and test each subgrade and each fill or backfill layer. Do not proceed until test results for previously completed work verify compliance with requirements.
  - 1. Perform field in-place density tests according to ASTM D 1556 (sand cone method) or other test method as considered appropriate by Geotechnical Engineer.
    - a. Field in place density tests may also be performed by the nuclear method according to ASTM D 2922, provided that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. With each density calibration check, check the calibration curves furnished with the moisture gages according to ASTM D 3017.
    - b. When field in place density tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
  - 2. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, perform at least one field in-place density test for every 2,000 sq. ft. or less of paved area or building slab, but in no case fewer than three tests.
  - 3. Foundation Wall Backfill: In each compacted backfill layer, perform at least one field in place density test for each 100 feet or less of wall length, but no fewer than two tests along a wall face.
  - 4. Trench Backfill: In each compacted initial and final backfill layer, perform at least one field in place density test for each 150 feet or less of trench, but no fewer than two tests.
- D. When testing agency reports that subgrades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, recompact and retest until required density is obtained.

- E. Owner's inspector will inspect foundation excavations when completed and ready for forms, after forms are in place, and before first placement of concrete.

### 3.16 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and re establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace material to depth directed by the Architect; reshape and recompact at optimum moisture content to the required density.
- C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.17 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 called for per Specification Section 01 50 00.
- B. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, re-shape to required tolerances, and compact to required density prior to further construction.

### 3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

**END OF SECTION**



**SECTION 32 12 16  
BITUMINOUS SURFACING**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. Provisions of Division 01 apply to this section.
- B. Section Includes:
  - 1. Paving for playground, parking areas, areas between buildings, synthetic track surfacing adjacent to planting and turf areas as indicated.
  - 2. Parking and existing non-concrete walk areas.
- C. Related Sections:
  - 1. Division 31: Site Clearing
  - 2. Division 31 : Earthwork
  - 3. Division 32 Pavement Marking

1.2 SUBMITTALS

- A. Shop Drawings: Submit site plan indicating extent of paving and accessories.
- B. Product Data: Manufacturer's technical data for materials and products.

1.3 QUALITY ASSURANCE

- A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction.

1.4 PROJECT CONDITIONS

- A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
- B. A copy of the soils report is available for examination in the office of the Architect during regular office hours of the Architect.

**PART 2 - PRODUCTS**

2.1 BITUMINOUS MATERIALS

- A. Provide materials of the class, grade, or type indicated on the Drawings, conforming to relevant provisions of Section 203 - Bituminous Materials of the Standard Specifications for Public Works Construction.

## 2.2 HEADERS AND STAKES

- A. Concrete: Per specification Division 03.

## PART 3 - EXECUTION

### 3.1 HEADERS

- A. Install headers along edge of bituminous surfacing abutting turf, earth, or planting area, unless indicated otherwise.
- B. Install headers so the bottom surface has continuous bearing on solid grade. Where excavation for headers is undercut, thoroughly tamp soil under the header. Compact backfill on both sides of header to the density of adjacent undisturbed earth.
- C. Remove existing headers where new surfacing is installed adjacent to existing surfacing.
- D. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

### 3.2 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

- A. Thickness of Surfacing: Unless otherwise indicated on Drawings or specified, install bituminous surfacing to a compacted thickness of 2 inches.
- B. Provide surfacing material over base course.
- C. Surfaces of walls, concrete, masonry, or existing bituminous surfacing indicated to be in direct contact with installed bituminous surfacing shall be cleaned, dried and uniformly coated with an asphaltic emulsion film.
- D. Thicken edges of bituminous surfacing that do not abut walls, concrete, or masonry, and edges joining existing bituminous surfaces. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be installed. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.
- E. At stairways, join surfacing to first tread or riser below first tread, at an elevation below first riser equal to height of risers of stairway.
- F. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive bituminous surfacing.
- G. Placing:
  - 1. Do not install bituminous surfacing when atmospheric temperature is below 40 degrees F; or when fog or other unsuitable weather conditions are present. Temperature of mixture at time of installation shall not be lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.

2. Where 2-inch or 3-inch thick surfacing is indicated or specified, install surfacing in one course. Where surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2-1/2 inches in thickness unless otherwise required by the Architect.
- H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent. Continuous screeds may be provided instead of stakes.
- I. Spreading: Install bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, install by mechanical means with a self-propelled mechanical spreader. In confined or restricted areas, install mixture with hot shovels and rakes, and smooth with lutes.
- J. Joints: Provide vertical joints between successive runs. Install joints true to line, grade, and cross section. Lapped joints are not permitted.
- K. Rolling:
1. Finish roll with a self-propelled tandem roller weighing at least 8 tons. Break down roll with a self-propelled roller weighing between 1-1/2 tons and 8 tons.
  2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.
  3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, true to line and grade. Tamp and smooth to properly compact.
  4. Compacted bituminous surfacing shall be provided with a bulk specific gravity of at least 2.31 when tested in accordance with ASTM D 1188.

### 3.3 TOLERANCE

- A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when a 10 foot straightedge is placed on surface.
- B. Grade: Finished grade shall not vary more than 0.02 foot above or below required grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are provided.
- C. Premium paving tolerances and requirements for synthetic track:

1. General: Test in-place asphalt concrete courses for compliance with requirements or thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by Owner's representative.
2. Thickness: Tolerances for thickness shall be ¼ inch, plus or minus.
3. Planarity: The asphalt substrate shall not vary from the planned cross slope by more than +0.1%. The finished asphalt shall not vary, plus or minus, under a 10 feet straight edge greater than 1/8". It is the responsibility of the paving contractor to flood test the surface with the use of a water truck. If, after 30 minutes on a 70 degree F day, "bird bath" are evident in a depth more than 1/8" the paving contractor, track surfacing contractor and the Owner's representative will determine the best method of correction.
4. Corrective Measures: It is the general contractor's responsibility to determine if the planarity, cross slopes, and general specifications have been met. If all of the conditions have been met the general contractor must notify the Owner in writing of the acceptance of the asphalt paving. This notification must include the acceptance of the paving by the track surfacing contractor.
5. No slurry or fog seals are to be applied to areas of asphalt paving that are to receive synthetic track surfacing. Problems with adhesion of synthetic surface are likely over seal coatings and warranty of the synthetic surfacing delaminating from the asphalt base will be voided.

### 3.4 TESTING

- A. After first coat of surface seal has been installed and after a 24 hour period, the flood test shall be completed of the bituminous surfacing in presence of the IOR. Repair areas of standing water or puddles and flood test locally; install surface seal and retest as necessary.

### 3.5 SURFACE SEALING

- A. After bituminous surfacing has passed flood test, clear and allow to dry and provide one more coat of surface seal as specified in Section 02786: Seal for Bituminous Surfacing.
- B. Where indicated, provide multiple coats of surface seal to existing bituminous surfacing.
- C. Where new bituminous surfacing joins existing bituminous surfacing, overlap surface seal a minimum of 12 inches onto existing bituminous surfacing.

### 3.6 PROTECTION

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

### 3.7 CLEANUP

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

## END OF SECTION

**SECTION 32 13 13  
SITE CONCRETE**

**PART 1 – GENERAL**

1.1 SECTION INCLUDES:

- A. Concrete walks, paving, ramps, curbs, walls, mow strips, fence footings and catch basins, and miscellaneous concrete site work as indicated on the drawings.
- B. Furnishing and installing formwork.
- C. Furnishing and installing reinforcing steel.
- D. Furnishing and placing concrete, including joints and finishing.
- E. Curing concrete.
- F. Repairing concrete work as required.

1.2 RELATED SECTIONS:

- A. Division 31: Earthwork
- B. Division 03: Cast-In-Place Concrete

1.3 SUBMITTALS

- A. All submittals shall be made in accordance with Division 1.
- B. Submit concrete mix designs for approval. Indicate intended use of each proposed mix design submitted.
- C. Samples: Prepare three samples of each type of concrete flatwork finish delineated on the plans for approval by the Architect. Each sample is to be a minimum of 4 square feet in area, and may be a part of the finished concrete site-work. Remove and properly dispose of any rejected samples, or those which are not part of the finished work, at no additional cost to Owner.

1.4 QUALITY ASSURANCE

- A. Conform to Section 01 43 00, Quality Control.
- B. Standards: Concrete work shall conform to the requirements of "Standard Specifications for Public Works Construction", Current Edition, PWC Specifications and herein specified.

**PART 2 - PRODUCTS**

2.1 MATERIALS

- A. Conform to Section 201 – "Concrete, Mortar and related materials" of the Standard Specification for Public Works Construction.
- B. Forms: Steel, wood, or other suitable material of size and strength to resist moving during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
  2. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- C. Reinforcing Steel:
1. Reinforcing Bars: ASTM A615, Grade 60.
  2. Welded Wire Mesh: ASTM A185.
  3. See Division 03: Reinforcing Bar.
- D. Concrete Materials:
1. Finished Concrete: Concrete class per PWC Specifications Section 201-1.1.2, except 6-inch reinforced concrete paving shall be 560-C-3500 concrete.
  2. Combined Aggregate: Gradation per PWC Specifications, Section 201-1.3.2.
  3. Cement: Portland Cement, Type II conforming to ASTM C-150.
  4. Water: Clear, clean and free from oil, vegetable matter and other deleterious substances.
- E. Redwood Headers: "Foundation" grade redwood as graded by Redwood Inspection Service.
- F. Control Joint Material:
1. Metal: "Keyed-Kold" with retained (removable) cap as manufactured by Burke Concrete Accessories, Inc., or approved equal.
  2. Plastic: "Quickjoint" T-shaped 1/16" plastic strip, 1 Inch minimum depth as distributed by J.A. Crawford Co. Phone (562) 698-0901, or approved equal.
  3. Pre-molded Expansion Joint Filler: ASTM 1751 non-extruding bituminous saturated resilient Joint filler.
- G. Bond Breaker: Resin type sealer. "Formfilm by A.C. Horn Co., "Form- Saver" by Sonneborn, or approved equal.
- H. Curing Materials:
1. Curing Paper: ASTM C171, non-staining, reinforced.
  2. Liquid Curing Compound: Non-staining, complying with ASTM C309 at manufacturers recommended rate of application. Deliver curing compound in unopened labeled containers.
    - a. For Gray Concrete (non-pigmented); Wax-free, fugitive resin type. Thompson's "Waterseal" or approved equal.
    - b. Pigmented Curing Compound: AASHTO Designation: M148, Type 11, white pigmented except that the loss of water in the water retention test shall not exceed 0.040- gram per square centimeter of surface.

- I. Abrasive Aggregate: Aluminum oxide (emery), alumina, or carborundum grains. "Emerendum" by Anti-Hydro, "Durafax" by Grace Construction Products, "Alundom Crystolon" by Norton Co., or approved equal.

### **PART 3 - EXECUTION**

#### **3.1 GENERAL**

- A. After PCC pavement areas have been brought to subgrade, the Soils Engineer shall test the subbase to verify the design R Value used. If required, Soils Engineer will recommend changes to the pavement section:
- B. If paving thicknesses changes due to required testing, contractor shall justify pavement sections accordingly.

#### **3.2 PREPARATION**

- A. General; Coordinate work with related trades. Do not locate related work in concrete except as detailed. Place conduits in concrete slabs with a minimum cover of 2" above and below conduit. Locate accurately and secure in place all inserts, bolts, ties, dowels, miscellaneous plates, etc., before pouring. They shall be clean and free from any coating which would reduce their bond.
- B. Base Course: Subgrade shall be smooth, true to line and grade, and tested for required compaction prior to start of placing concrete. Dampen subgrade 24 hours before placing. Reroll as required. Wet forms to tighten cracks.
- C. Reinforcing Steel: Position, support and secure reinforcement against displacement. Locate and support with metal chairs, runners, bolster, spacers and hangers, as required. Set wire tie so ends are directed into concrete, not toward exposed concrete surfaces.
- D. Formwork: Stake rigidly at 4 feet on center and secure against displacement. Install stretched wires or other devices to indicate displacement. Formwork shall not deviate more than 1/8" from required positions and levels. Curb forms shall be smooth on the side placed next to the concrete, and shall have a true smooth upper edge. The depth of forms for back of curbs shall be equal to the full depth of the curb. The depth of face forms shall be equal to the full face height of the curb. Carefully set forms to alignment and grade and to the required dimensions. Hold forms rigidly in place by stakes, clamps, spreaders and braces as required to insure rigidity. Benders or thin plank forms may be used on curves, grade changes, or for curb returns. Back forms for curb returns may be made of 1/2 inch thick benders cleated together for full depth of the curb. Do not remove the form on the front of the curbs in less than one hour nor more than six hours after the concrete has been placed. Do not remove side forms for sidewalks, gutter depressions, island paving and driveways, less than 12 hours after the finishing has been completed.

#### **3.3 CONCRETE MIX**

- A. Comply with requirements of PWC Specifications, Section 201-1.3 proportioning and Section 201-1.4 mixing and as herein specified. Concrete strength shall be 2500 psi at 28 days unless specified by Architect or plans to be of a greater strength for the application-specific purpose.

#### **3.4 PLACING CONCRETE**

- A. General: Place concrete in accordance with PWC Specifications Section 303-5.3.

### 3.5 CONTROL JOINTS

- A. Control Joints; Locate as indicated; where not shown locate at maximum 15 feet on center for flatwork and 30 feet on center for curbs. Tool edges except at structures.
  - 1. Plastic Joints: Immediately following preliminary troweling, part concrete to a depth of 2 inches with #750 Lightweight Cutter Bar. Install plastic joint material so that the pull-top stiffener is flush with the top of concrete and immediately peel off pull-top stiffener. After pull top is removed, float concrete to fill all voids adjacent to strip. During final troweling, finish edge to a maximum radius of 1/8" Using a #355 or #350 slit jointer tool.
  - 2. Metal Joints: Install "Key-Kold" metal joint form. Set top of stakes 3/8" below slab surface elevation. Install with minimum of 5 stakes per 10 foot length. When concrete is not poured continuously over both sides of the joint, the knock-out anchors shall be bent at a 45 degree angle into the pour. Finish the concrete to the top of the joint and burn in with hand trowel.
  - 3. Saw Cutting: Prior approval of Architect required. Saw cut shall be 1/4 depth of slab. Joints shall be cut to a chalk line. Saw cutting time shall be determined from preliminary saw cut indicating that concrete is set up sufficiently to prevent raveling at the cut.
- B. Expansion Joints at Structures: Provide 1/2" minimum pre-molded Joint filler for expansion joints abutting concrete curbs, catch basins, manholes, nets, structures, walks and other fixed objects, unless otherwise indicated.
  - 1. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
  - 2. Joints between slabs and structures: install 30 lb. building paper strip against wall of structure for pour splash protection as well as to prevent bond to wall. Trim off even with surface of concrete slab.
- C. Design/Control Joints:
  - 1. General: Joints shall be true to line and profile. tooling shall be done while concrete is plastic. Joint may be started with a straightedge inserted into concrete.
  - 2. Jointing Tool: Shall be 1/4" wide at surface, tapered, with top edges rounded to 1/4" radius.
  - 3. Location: As shown on drawings, but in any case not more than 15 feet on center both ways. Typical sidewalk joints shall be jointed at 5 feet on center or as directed by Architect.

### 3.6 FINISHING

- A. Smooth Finish: Steel trowel and burnish to a smooth, dense, and hard finish.
- B. Medium Broom Finish: Broom finish by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
- C. Walks and Sidewalks:



1. Slopes less than 6 percent: Surfaces with a slope equal to or less than 5 percent gradient shall be at least as slip-resistant as that described as a medium broom finish.
  2. Slopes 6 percent or greater: Surfaces with a slope of 6 percent grade shall be heavy broom finish.
- D. Abrasive: Exterior stair treads, ramps and landings shall receive a nonslip, light broom finish in addition to abrasive finish of abrasive grains in amount of 30 pounds per 100 square feet shall be evenly applied by the "dust-on" method and embedded in to the surface during the first troweling operation. Additional abrasive grains, in the amount of 30 pounds per 100 square feet, shall then be evenly applied and embedded into the surface during the final troweling operation.
- E. Curbs. Prior to the removal of curb forms, the surface shall be finished true to grade by means of a straight edge float, not less than 10 feet in length, operated longitudinally over the surface of the concrete. Smooth trowel face of curb immediately after removal of front curb form to a depth of not less than 2 inches below the flow line. Steel trowel face and tops of curb and provide rounded front and back edges. After the face of the curb has been troweled smooth, it shall be given a final fine brush Finish with brush strokes parallel to line of curb. Top and face of curbs shall be true and straight, of uniform width, free from humps, sags or other Irregularities.
- F. Other Flatwork: Finish to grade and cross section with a float, trowel smooth and finish with a broom, unless otherwise specified. Float shall not be less than 10 feet in length and not less than 6 inches in width.

### 3.7 CURING

- A. Moist Curing for Natural concrete: Cover with reinforced waterproof curing paper. Seal all joints and weight down edges. Maintain moist for 14 days.
- B. Liquid Curing Compound for Natural Concrete: Locations as approved by Architect. Apply a uniform coating within 2 hours of final troweling.

### 3.8 REPAIRS AND PROTECTIONS

- A. Repair or replace broken or defective concrete, as directed by Architect.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur. If appropriate, concrete may be covered with construction plastic guard or visquene to protect surface finish.
- C. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

**END OF SECTION**

**SECTION 32 13 15  
PAVEMENT MARKING**

**PART 1 – GENERAL**

1.1 REFERENCE:

- A. Requirements in Addenda, Alternates, Conditions, and Division 1 collectively apply to this work.
- B. Related Sections:
  - 1. Division 31:
  - 2. Division 32:

1.2 DESCRIPTION:

- A. Principal Work Items Are:
  - 1. Painted lines, lettering, and symbols at parking areas.
  - 2. Painted stripes at exterior stairs.
  - 3. Painted lines for sport courts.
  - 4. Fire Lane “No Parking.”
  - 5. Curb marking and red curbs.

1.3 JOB CONDITIONS:

- A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, 50 deg F for water-based materials, and not exceeding 95 deg F.
- B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces seal coats.
- C. Protection: Do not apply pavement markings for seven days after application of asphalt surface seal coat. After application, protect from traffic until thoroughly dry.

**PART 2 - PRODUCTS**

2.1 MATERIALS:

- A. Traffic Paint:
  - 1. Type: Water base, roadway traffic lane marking type; colors as selected.
  - 2. Acceptable Manufacturers:
    - a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.
    - b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9 Red.
    - c. Sinclair No. 160 Vinyl Traffic Line Paint, water base.
    - d. Pervo Paint Company.

## **PART 3 – EXECUTION**

### **3.1 PREPARATION:**

- A. Layout: Accurately measure and layout work. Use stencils for all work; snap lines for straight work.
- B. Prior to application of paint, allow the pavement to properly cure. Clean and prepare in accordance with paint manufacturer's written recommendations.
- B. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.
- C. Do not permit traffic until paint has completely cured.
- D. Install 2 coats in thickness recommended by manufacturer.

### **3.2 APPLICATION:**

- A. Painted Lines, Lettering, and Symbols At Parking Areas:
  - 1. Parking Stall Lines: 4 inches wide, color white.
  - 2. Wheelchair accessible parking stalls, stripes and letters: As indicated.
  - 3. Color: White, for all work except blue at wheelchair accessible parking stalls and red to indicate "No Parking".
  - 4. Specific areas designated as fire lanes must be marked with red curbs using OSAH safety red paint. "FIRE LANE – NO PARKING" shall be painted on the top of curb in 3" white lettering at a spacing of 30' on center or portion thereof.
  - 5. Painted lines and markings on pavement at wheelchair accessible parking stalls shall be 4 inches wide (blue in color) equal of Color No. 15090 per Federal Standard 595B.
  - 6. Parking spaces for persons with disabilities shall be marked according to CBC Section 1129B.5.
  - 7. Tactile warning lines shall be in conformance to CBC Section 1133B.8.3 and 1133B.8.4.
  - 8. Traffic Directional Arrows: Paint directional traffic flow arrows in all aisles, and at parking lot entrances and exits.
- B. Stripes At Exterior Stairs:
  - 1. Stripes: 2" wide, located 2" from, and parallel to, nosing.
  - 2. Required Locations: All treads, all top landings, all intermediate landings.

**END OF SECTION**

**SECTION 32 31 13**  
**SITE METAL FABRICATIONS**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES:

- A. Metal fabrications as indicated or required, including items such as:
  - 1. Steel pipe
  - 2. Square and rectangular steel tubing
  - 3. Pipe columns
  - 4. Handrails and guardrails
  - 5. Steel thresholds
  - 6. Steel ladders
  - 7. Gratings, frames and covers
  - 8. Miscellaneous fabrications as indicated.

1.2 RELATED SECTION:

- A. Supporting Construction: Related Sections.
- B. Section 03 30 00: Cast-in-Place Concrete
- C. Section 05 12 00: Structural Steel
- D. Section 05 50 00: Metal Fabrications
- E. Section 09 90 00: Painting

1.3 QUALITY ASSURANCE:

- A. Reference specifications and standards:
  - 1. Design, fabricate and erect miscellaneous metals in accordance with AISC'S Design, Fabrication and Erection of Structural Steel for Buildings, Titles 24, CCR.
  - 2. AWS D-1. Code for Welding in Building Construction.

1.4 SUBMITTALS:

- A. All submittals shall be made in accordance with Section 01 33 00.
- B. Shop Drawings: Submit shop drawings showing materials used, dimensions, and anchoring details. In addition include the following: steel grades, fasteners, size and extent of welds.
- C. Samples:
  - 1. Railing.
  - 2. Rail brackets, each type.

- D. Certifications: Submit for items hot dip galvanized to identify items and to show compliance of application.

#### 1.5 PRODUCT HANDLING:

- A. Store miscellaneous metal items above ground on platforms, skids or other approved supports.
- B. Protect metals from corrosion.

### **PART 2 - PRODUCTS**

#### 2.1 MATERIALS:

- A. Structural Steel Shapes: "Standard Specifications for Structural Steel", ASTM A 36.
- B. Steel Pipe:
  - 1. Steel pipe other than pipe used for structural purposes shall conform to "Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses", ASTM A120, or ASTM A53.
- C. Cast Steel: "Standard Specification for Mild-to-Medium Strength Carbon-Steel Castings for General Application" ASTM A 27, Grade 65-35.
- D. Steel Bolts: "Standard Specification for Carbon Steel Externally and Internally Threaded Standard Fasteners", ASTM A 307, Grade A, with bolt head and nut dimensions conforming to ANSI B 18.2.1.
- E. Rolled steel plates and shapes:
  - 1. Shapes and plates shall conform to ASTM A 36, except for plates to be bent or cold-formed.
  - 2. Plates to be bent or cold-formed shall conform to ASTM A283, Grade C.
- F. Stainless Steel: ASTM A167 and A269, ANSI Type 304.
- G. Aluminum
  - 1. Extrusions: ASTM B221, 6063-T5 alloy, 1/8" thickness minimum.
  - 2. Sheets: 6061 alloy, No. 16 gage minimum.
- H. Cast Iron: Provide with minimum tensile strength in accordance with ASTM A48, Class 30, unless otherwise required.
- I. Malleable Iron casting: ASTM A47.
- J. Ductile Cast Iron: ASTM A536.
- K. Fastening Devices
  - 1. Threaded Fasteners:
    - a. For Steel: Low carbon steel, ASTM A307, hot dip galvanized for exterior use and where galvanized assemblies are indicated.
    - b. For Stainless Steel and Aluminum: Use stainless steel, ANSI Type 304.

2. Stud Bolts and Concrete Anchors: Galvanized studs of type and size as specified or required for each loading condition.

L. Primers and Protective Coatings

1. Ferrous Metal Primer-General Purpose: Use where no other primer specified on commercial blast or power tool cleaned prepared steel as undercoat for alkyd or oil base finish systems.
  - a. Modified Alkyd rust-Inhibitive Primer, Series 4 - "Versare 4-55", as manufactured by Tnemec Inc.
  - b. Alkyd Metal Primer "Kem Kromik" by Sherwin-Williams Co.
  - c. Or equal.
2. For Elements of Steel Specified to be Top Coat Finished with Polyurethane Paint: Use two part high build Epoxy Primer with minimum 54% solids by volume. Provide Series 69, Hi-Build Epoxoline II, as manufactured by Tnemec, Epoxy high build by Sherwin Williams, Pitt-Guard DTR 97-147/149 by P.P.G., or equal. Use color tinted to approximated finish top coat. See also Section 09900, Painting.
3. Protective Coatings For Other Conditions Specified for Item Fabrication or Installation:
  - a. Bituminous Paint: Fed. Spec. TT-C-494.
  - b. Zinc Dust Primer: Fed. Spec. TT-P-460.
  - c. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing weld areas made in galvanized steel.
4. Galvanizing: Reference Finishes for Fabrication Standards (Article 2.2) as specified herein.

- M. Supplementary Parts: Provide materials or assembly components as specified or shown for fabricated item or as necessary to complete each item of work, even though such supplementary parts are not shown or specified.

2.2 FABRICATION:

A. General

1. For the fabrication of items which will be exposed to view, use only materials which are smooth and free of blemishes. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coatings.
2. Form exposed work true to line and level with accurate angles and surfaces, and straight sharp edges.
3. Ease exposed edges to a radius of approximately 1/32 in., unless otherwise indicated or specified.
4. Form bent metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.
5. Form exposed connections with hairline joints that are flush and smooth, using concealed fasteners wherever possible.
6. Remove loose rust, mill scale, cutting and punching burrs.
7. Fabricate items in as large sections as practical to minimize field jointing.

- B. Welding:
1. Weld all shop connections and all field connections unless indicated or specified otherwise.
  2. Weld corners and seams continuously and in accordance with the requirements of the AWS Code. All welds shall be inspected as required in section "Structural Steel".
  3. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- C. Galvanizing:
1. "Standard Specification for Zinc (Hot-galvanized) Coatings on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip", ASTM A123.
  2. All exposed items shall be hot-dip galvanized, in as large sections as possible.
- D. Protective Coatings
1. Contact Condition Requiring Protection
    - 1) Whenever dissimilar metals will be in contact.
    - 2) Wherever aluminum metals will be in contact with or embedded in concrete, cement, mortar, plaster, or masonry.
  2. Application: Separate contact surfaces by coating each contact surface prior to assembly or installation with one coat of bituminous paint or zinc based primer to suit condition and approved by Architect. Mask off those surfaces not required to receive protective coating.
- E. Shop Finish:
1. All miscellaneous metal fabrications, except galvanized items, which will be exposed when the building is completed, shall receive a coat of primer.
  2. The primer specified shall be spray applied, covering all surfaces with a smooth unbroken film. The minimum dry film thickness of the primer shall be 2. mils.
  3. Preparation for Painting: All miscellaneous ferrous metal, except items specified galvanized or shop primed, shall be thoroughly cleaned of all mill scale, grease, dirt or rust, by scraping, wire brushing, or sandblasting and shall be delivered to the job unpainted, but in proper condition for painting. Shipping oil or other protective coatings shall be removed.

## 2.3 FABRICATED ITEMS

### A. Miscellaneous Steel Framing

1. Framing, bracing, supports, framing, clip angles, shelf angles, plates, grating, etc., shall be of such shapes and sizes as indicated on the drawings and details, or as required to suit the condition.
2. Fabricate with all necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc. as required to properly support and rigidly fasten and anchor steel framing in place and to steel, concrete, masonry and all other connecting and adjoining work.

3. Framing steel shall be furnished in accordance with the applicable requirements of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" by the American Institute of Steel Construction and as herein specified.
  4. All exposed items shall be hot-dip galvanized, in as large sections as possible.
- B. Sleeves in Foundation and Structure: Furnish for setting with concrete placement.
1. Sleeves through exterior foundation walls shall be minimum Schedule 40 steel pipe with inside diameter 2" larger than outside diameter of pipe or conduit (including insulation, if any) to be accommodated. Sleeves shall project one-half inch (1/2") on each side of finished wall. Fabricate with rectangular one-quarter inch (1/4") steel plate collar at center of wall condition, continuously welded to the perimeter of the sleeve, and six inches (6") wider than the sleeve outside diameter.
  2. Slots in concrete slabs shall be 12 gauge steel sheet, galvanized, of opening dimensions indicated, with strap anchors welded in place not more than twelve inches (12") on centers.
  3. All exposed items shall be hot-dip galvanized, in as large sections as possible.
- C. Steel Ladders: Conform to OSHA standards.
1. Vertical steel ladders shall be 18" wide with 3/4" diameter non-slip steel rungs spaces 12" on center welded to minimum 3/8" thick by 2-1/2" wide steel bar stringers.
    - a. As shown on drawings, or determined by detail engineering of Contractor's Engineer, provide ladder stringer of larger size to accommodate height (span) of ladder assembly.
  2. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
    - a. Use welded or bolted steel brackets, designated for adequate support and anchorage, and to hold the ladder clear of the adjacent wall surface with a minimum of 7" clearance from wall to centerline of rings.
    - b. Extend rails 42" above top rung, and return rails to wall or structure. Do not rest bottom of roof rails on finished roofing or waterproofing surface.
  3. Fabricate to install ladders with attachments to walls 6" from top and bottom and with maximum intermediate support spacing 36" on center from the specified top and bottom locations. All exposed items shall be hot-dip galvanized, in as large sections as possible.
- D. Steel Pipe Railing Handrails and Gates
1. Provide 1-1/2" "nominal diameter" (actual O.D. 1.9") steel pipe, minimum size, in accordance with ASTM standard, Schedule 40 minimum.
    - a. Brackets shall be as detailed on drawings or subject to approval of Architect.
    - b. Use heavier weight rails (Schedule 80) or reinforce rails internally if necessary to meet Performance Standards specified in Article 1.2, herein.
  2. Construction: Form direction changes in rails using solid bar stock or elbows. Connections shall be shop welded and ground smooth and flush, except where field connections and expansion joints are required. Field connections may be



welded, internal sleeve and plug weld, or internal sleeve and set screw. All exposed items shall be hot-dip galvanized, in as large sections as possible.

3. Secure handrails to walls with wall brackets. Coordinate bracket spacing to meet architectural alignments or otherwise required by Project Conditions.
  - a. Drill wall plate portion of the bracket into concrete to receive expansion bolts for concealed anchorage.
  - b. Locate brackets at not more than 5'-0" on center unless otherwise shown.
4. Provide wall return fitting, flush-type, with the same projection as indicated for wall brackets.
5. Post Anchorage: Provide side mounted or base mounted (set in concrete) post anchorage as indicated for each location and in accordance with approved shop drawing.
  - a. For steel pipe posts base mounted and set in concrete: Anchor posts in concrete by means of pipe sleeves set and anchored into concrete.
    - 1) Provide sleeves for core drill installation of galvanized steel pipe, not less than 9" long, and having an inside diameter not less than 1/2" greater than outside diameter of the inserted pipe. Provide steel plate closure secured to bottom of sleeve and of width and length not less than 1" greater than outside diameter of sleeve.
    - 2) After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non shrink, non-ferrous grout.
    - 3) Cover anchorage joint with a round steel flange welded to post with welds ground smooth. Posts shall be set plumb within 1/8" vertical tolerance for full post height.
6. Longitudinal members shall be parallel with each other and with floor surface or shape of stair to a tolerance of 1/8" in each 10'-0" length. Center line of members within each run of railing shall lie in the same vertical plane.
  - a. Posts and other vertical components shall be set plumb within 1/8" from top to bottom of assembly.
  - b. Shop and field joints of connecting sections shall be hairline (1/32" or less).

E. Metal Saddles

1. General: Metal saddles shall be of profiles indicated on drawings, or otherwise approved by Owner's Representative in single piece, full wide of door jambs (unless indicated otherwise), shaped to fit jambs and other adjoining work.
  - a. Cut, drill and fit saddles as required to for door hardware.
  - b. Saddles for exterior doors shall have weather-stop rabbet (unless indicated otherwise).
2. Aluminum Saddles: Typical for Project conditions unless steel or other material indicated. Provide extruded aluminum with fluted top surface, 1/2" high maximum, 1/8" thick minimum. Caustic etch and clear anodized (0.07 mil thickness) finish, Aluminum Association finish designation C22-A31.

- F. Water Heater Brackets: Fabricate of structural shapes as detailed. Coordinate with Division 15 to assure fit of water heater to be furnished.

- G. Ornamental Fences and Gates:
1. Provide ornamental fence and gates as indicated and detailed on the drawings. Fabricate from hot or cold-rolled tubing, bars and shapes, welded at all joints and ground smooth. Hot dip galvanized after fabrication. All gate mounting hardware shall be furnished by gate manufacturer, padlocks shall be furnished under Section 08710, Finish Hardware.
  2. Set posts into concrete footings as indicated or, if not indicated, into 3'-0" deep minimum footing to withstand strain of use.
- H. Other Miscellaneous Items: Provide of materials, sizes, profiles, and conditions shown on Contract Drawings and as specified in Article 3.1 herein, for installation. Items include but are not limited to the following:
1. Pipe Guard Posts and Bollards: Fabricate of hot dip galvanized steel.

### **PART 3 – EXECUTION**

#### **3.1 INSTALLATION:**

- A. General: Install work of this Section square, plumb, straight, true to line or radius, accurately fitted and located, with flush tight hairline joints (except as indicated otherwise or to allow for thermal movement), with provisions for other work, with provisions to allow for thermal movement, with provision to exclude water where exposed to the weather, and with attachment devices as required for secure and rigid installation.
- B. Attachments: Unless indicated otherwise, work to be built into concrete shall be anchored with shop-welded-on steel strap anchors, work to be attached to concrete or masonry shall be anchored by bolts into embedded metal inserts or expansion shields.
1. Provide shims, slotted holes, or other means necessary for leveling, plumbing and other required adjustments.
  2. Steel attachment devices for exterior steel work and for galvanized steel work shall be galvanized.
  3. Attachment devices for work exposed to view shall be concealed, unless indicated otherwise; all other attachment devices shall be located where least conspicuous. Where bolts or screws are permitted to work exposed to view, they shall be flat and countersunk, with projecting ends cut off flush with nuts or adjacent material.
  4. Do all necessary drilling, tapping, cutting or other preparation of surrounding construction in the field accurately and neatly. Provide for the attachment and support of work specified in this Section.
- C. Structural/Loading Criteria
1. Railings: All railings shall be fabricated and installed in accordance with design requirements specified herein.
  2. Install work of this Section to provide items with capabilities to safely sustain or withstand stresses and strains to which materials and assembled work will be subjected. Comply with Project loading and structural criteria and regulatory requirements.
- D. Field Welding: Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

- E. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units at Contractor's option.
- F. Field Painting: See Articles "Fabrication Standards" and references to "Prime Painting", and "Protective Coatings". Finish painting is specified in Section 09900, "Painting".
- G. Dissimilar Materials
  - 1. Field Painting: See Articles "Fabrication Standards" and references to "Prime Painting", and "Protective Coatings". Finish painting is specified in Section 09900, "Painting".
  - 2. Aluminum to Other Metals: Isolate aluminum tubing from dissimilar metals by coating dissimilar metals with heavy-bodies bituminous paint or with one (1) coat zinc chromate primer and two (2) coats aluminum metal and masonry paint or by using a non-absorbent gasket.
  - 3. Aluminum to Treated Wood: Isolate aluminum from non-compatible preservative treated wood, and from all absorptive material subject to repeated wetting. Paint aluminum with two (2) coats of aluminum metal and masonry paint.
  - 4. Touch up: Recoat shop applied protective coatings if damaged.
- H. Apply bitumastic coating (bituminous paint) to steel at all concrete embedments, and extend coating one inch past top of concrete in a neat manner.

**END OF SECTION**